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INFRARED ABSORPTION BY CH_4, H_2O AND CO_2

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Spectral absorption data are presented for CH_4 between 1150 cm^{-1} and 1400 cm^{-1}, CO_2 between 500 cm^{-1} and 850 cm^{-1}, and H_2O between 333 cm^{-1} and 444 cm^{-1}. Also included are data on the continuum absorption by H_2O between 800 cm^{-1} and 1250 cm^{-1}. The samples represented cover wide ranges of the amount of absorbing gas, pressure and temperature. The data are intended primarily to provide checks for the atmospheric absorption line parameters compiled by the Air Force Geophysical Laboratories.

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SECTION 1

INTRODUCTION

BACKGROUND

The primary purpose for the experimental work reported herein has been to provide absorption data to check the Air Force Geophysical Laboratories (AFGL) line-parameter listing[1] and to serve as a basis for possible modification to the listing. The particular absorption bands studied have been selected because of current applications that require that the absorption by these bands in known atmospheric paths be predictable as accurately as possible. Emphasis has been placed on data from which improved values of line intensities, line widths and continuum absorption coefficients can be determined. No new data are reported on line positions because reliable data on the center positions of most of the significant absorption lines are either already incorporated in the AFGL listing or are available elsewhere.

Section 2 provides spectral data on the absorption by CH_4 between 1150 and 1400 cm^{-1}. Absorption in the lower atmosphere by CH_4 is typically much less than that by H_2O in this same spectral region. However, in the less humid, upper atmosphere, CH_4 produces a large fraction of the absorption that occurs. Because of the complex nat of CH_4 absorption spectra, it is quite difficult to derive a set of CH_4 line parameters from which absorption spectra can be predicted accurately. Recent comparisons of calculated spectra with experimental data indicate that major revisions in the current listing of CH_4 lines are in order. Relative intensities of many of the individual lines can be checked with the detailed data provided in Section 2. The samples investigated cover wide ranges of absorber thickness and pressure with the temperature near 304K.

Some new and improved data are presented in Section 3 on the continuum absorption by pure H_2O between 600 and 1300 cm^{-1}. Some of these data are believed to be more accurate than similar data reported previously by us.[2] Impurities in the H_2O samples studied previously may have resulted in values of the continuum absorption coefficient that are too high by as much as 20 percent in some parts of this spectral region. The samples reported in Section 3 varied in temperature from 296K to 430K. The continuum absorption coefficient decreases rapidly with increasing temperatures.

Detailed spectral data are presented in Section 4 on the absorption by H_2O between 333 and 444 cm^{-1}. Calculating H_2O absorption in this spectral region from a list of line parameters is complicated by the apparent presence of some continuum absorption in addition to absorption by the lines centered within the region. The data in Section 4 represent samples that cover wide

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[1] R. A. McClatchey, W. S. Benedict, S. A. Clough, D. E. Burch, R. F. Calfee, K. Fox, L. S. Rothman, and J. S. Garing, "AFCRL Atmospheric Absorption Line Parameters Compilation", AFCRL-TR-73-0096, 26 January 1973. (Associated with this report is a magnetic tape listing the line parameters.)

[2] D. E. Burch, "Investigation of the Absorption of Infrared Radiation by Atmospheric Gases"; Semi-Annual Technical Report, Contract F19628-69-C-0263, 31 January 1970.

ranges of absorber thickness and pressure, making it possible to determine the relative contribution by the continuum and by nearby lines.

Absorption and emission by the well-known 15 μm bands of CO_2 forms the basis for experiments on the remote sensing of the atmospheric temperature profile from satellite-borne instruments. The many overlapping bands in this region make it difficult to calculate accurately the irradiance at the top of the atmosphere, or at a satellite, within any narrow spectral interval in the band system. The extensive data presented in Section 5 are intended to provide a means of checking the intensities, widths, and shapes of the CO_2 lines that are involved in the atmospheric calculations. The samples studied cover wide ranges of absorber thickness and pressures from approximately 0.002 atm to 1 atm. Three sample temperatures, approximately 245 K, 274 K and 310 K, were employed to represent most of the temperature range in the earth's atmosphere. Although temperatures somewhat lower than those employed occur in the atmosphere, the wide temperature range of the samples studied should provide a reliable check on the predicted temperature dependence. Thus, reliable extrapolation to lower temperatures should be possible after the best possible set of line parameters has been derived.

DEFINITIONS, SYMBOLS, AND NOMENCLATURE

The absorber thickness, u, of a gas sample is given by

$$\begin{aligned} u(\text{molecules/cm}^2) &= 2.69 \times 10^{19}\ p^*\ (\text{atm})\ L(\text{cm})\ (273/\theta) \\ &= 7.34 \times 10^{21}\ p^*\ L/\theta. \end{aligned} \tag{1}$$

The temperature θ is in degrees Kelvin, and L is the geometrical path length through the sample. The density-equivalent-pressure p^* of the absorbing gas may vary slightly from the partial pressure p at high pressures. The gas does not follow exactly the perfect gas law at the higher pressures for which the Van der Waals' equation of state is required. The deviation from the perfect gas law causes a non-linear relationship between the pressure and the density of the gas. At partial pressures less than 1 atm, p can be substituted for p^* without introducing significant error, but p^* may differ significantly from p at high pressures. For all of the pressures used in the present investigation, the following simple expression is sufficiently accurate:

$$p^* = p(1 + c\,p) \tag{2}$$

The pressures are in atm, and c depends on the gas species and temperature. Near room temperature, $c \cong 0.005$ for CO_2, and 0.002 for CH_4. When a sample consists of two or more gas species, the total pressure is represented by P.

The true transmittance that would be observed with infinite resolving power is given by

$$T' = \exp(-uk), \qquad \text{or} \qquad (-1/u) \ln T' = k, \tag{3}$$

where k is the absorption coefficient. Because of the finite slitwidth of a spectrometer and variations in k with wavenumber due to line structure, the observed transmittance T may differ from T' at the same wavenumber. The quantity T represents a weighted average of T' over the interval passed by the spectrometer.

The absorption coefficient due to a single collision-broadened absorption line at a point within a few cm^{-1} of the line centers, ν_o, is given approximately by the Lorentz shape:

$$k_L = \frac{S_J}{\pi} \frac{\alpha}{(\nu - \nu_o)^2 + \alpha^2}. \tag{4}$$

The line intensity

$$S_J = \int k d\nu \tag{5}$$

is essentially independent of pressure for the conditions of the present study. It has been shown [3, 4, 5] that for $|\nu - \nu_o|$ greater than a few cm^{-1}, the Lorentz equation may require modification. The equation can be modified by employing a correction factor χ, which is a function of $|\nu - \nu_o|$, so that

$$k = k_L \chi = \frac{S}{\pi} \frac{\alpha\chi}{(\nu - \nu_o)^2 + \alpha^2}, \tag{6}$$

where k_L denotes the value given by the Lorentz coefficient. The value of χ is approximately equal to unity for small $|\nu - \nu_o|$, but may be quite different for large $|\nu - \nu_o|$. For example, $\chi \ll 1$ for the extreme wings of CO_2 lines,

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[3] D. E. Burch, D. A. Gryvnak, R. R. Patty, and C. E. Bartky; J. Opt. Soc. Am. 59, 267 (1969). Also Publication No. U-3203, Philco-Ford Corporation, Aeronutronic Division, Contract NOnr 3560(00), 31 August 1968.

[4] B. H. Winters, S. Silverman, and W. S. Benedict: Journal of Quantitative Spectroscopy and Radiative Transfer 4, 527 (1964).

[5] D. E. Burch, D. A. Gryvnak, and J. D. Pembrook; "The Absorption by H_2O Between 1630 and 2245 cm^{-1}", Philco-Ford Report U-5090, Contract No. F19628-73-C-0011, January 1973.

but χ may be greater than 1 for H_2O lines. (Ref. 5). Most of the samples in the present study were at sufficiently high pressures for collision broadening to be dominant. Under this condition, the line half-width α is proportional to the collision frequency and thus to the gas pressure. At pressures less than approximately 0.01 atm, the more complex Voigt profile is appropriate.

In many reports and papers, including ones published previously by us, S_J is called line strength. In order to conform with the majority of the workers in the field, we now refer to S_J as the intensity, not the strength. The terms S_v refers to the intensity of a vibration-rotation band that contains many lines. The combined intensity of a system of bands is denoted by S_{sys}. If essentially all of the absorption in a given spectral region results from a system of overlapping bands, we see from Eq. (3) that

$$S_{sys} = \int k\, d\nu = (-1/u) \int \ln T'\, d\nu. \tag{7}$$

When the spectral slitwidth is only a few-tenths of a cm^{-1} wide and gas samples are pressurized to approximately 10 atm or more, the observed transmittance T is very nearly equal to the true, monochromatic transmittance T'. Under this condition, $\int \ln T'\, d\nu$ is approximately equal to the measurable quantity $\int \ln T\, d\nu$ so that S_{sys} can be determined experimentally. The intensity of the CH_4 band system reported in Section 2 has been measured by this suggested method from spectra of high-pressure samples of $CH_4 + N_2$.

Because of differences in the efficiencies of collisions with molecules of different gas species, the half-width α of a collision-broadened line depends on the partial pressure of each of the gas species present in a sample. The equivalent pressure P_e given by the following equation is a convenient parameter when dealing with absorption by a mixture that contains non-absorbing N_2 in addition to the absorbing gas species:

$$P_e = Bp + p_{N_2} = (B-1)\, p + P, \tag{8}$$

where P is the total pressure, P_{N_2} is the partial pressure of N_2, and p is the partial pressure of the absorbing gas species. The experimentally determined constant B is the ratio of the self-broadening ability to the broadening ability of N_2. The equivalent pressure is therefore directly proportional to α, regardless of the relative concentrations of the absorbing gas and the N_2. We note that P_e approximates P for dilute mixtures of the absorbing gas species in N_2 ($p \ll P_{N_2}$). The CO_2 samples discussed in Section 5 consisted of CO_2 plus dry air; the dry air consisted of 79% N_2 and 21% O_2 to closely approximate the atmosphere. The same symbol, P_e, represents the equivalent pressure of these samples with p_{air} replacing P_{N_2} in Eq. (8).

Because of the proportional relationship between α and pressure, k is also proportional to pressure in the extreme wings of a line where $|\nu - \nu_o| >> \alpha$. It follows from Eq. (6) that the wing-absorption coefficient C due to the extreme wings of several lines is equal to the sum of all k's due to the individual lines and is proportional to pressure. Because wing absorption changes slowly with wavenumber, it is frequently called continuum absorption. Continuum absorption may also arise from dimers, such as $H_2O{:}H_2O$, or from pressure-induced bands. These two types of continuum have the same pressure dependence as absorption by line wings; therefore, in some cases we cannot distinguish which is the source of the absorption being measured. The absorption coefficient due to local lines whose centers occur within a few cm^{-1} of the point of observation is denoted by $\mathcal{k}$(local). This quantity may vary rapidly with wavenumber and depends on pressure because of collision-broadening of the absorption lines. At a given wavenumber, there may be absorption by local lines as well as by continuum. Therefore, for a pure H_2O sample, the total absorption coefficient $\mathcal{k}$ in Eq. (3) is given by

$$\mathcal{k} = \mathcal{k}(\text{local}) + C_s^o p. \tag{9}$$

The normalized continuum coefficient C_s^o is the value of C_s at a given temperature when p = 1 atm. The subscript s denotes self-broadening of the lines. Since α_s^o is proportional to p, and u is proportional to pL, it follows that $(-\ln T)$ for continuum due to the wings of lines is proportional to p^2L.

For a mixture of $H_2O + N_2$, such as several of those used in the present study, Eq. (9) must be modified to account for broadening of the H_2O lines by N_2.

$$\mathcal{k} = \mathcal{k}(\text{local}) + C_s^o\, p + C_{N_2}^o\, p_{N_2}. \tag{10}$$

Consider the continuum at a wavenumber where the absorption is due to the wings ($|\nu - \nu_o| >> \alpha$) of several lines with the Lorentz shape given by Eq. (4). It follows from the above discussion that C_s^o / C_{N2}^o is equal to the ratio $\alpha_s^o / \alpha_{N2}^o$ of the normalized half-widths for self-broadening and N_2 broadening. Previous results of measurements at wavenumbers where most of the absorption is due to H_2O lines centered between approximately 1 and 20 cm^{-1} away from the point of the measurement indicate that this ratio is approximately 5. However, at wavenumbers where much of the absorption is apparently due to more distant lines, the ratio C_s^o / C_{N2}^o may be much greater than 5. These results indicate that the extreme wings of lines are non-Lorentzian and that the correction factor χ (Eq. (5)) is greater at large $|\nu - \nu_o|$ for self-broadened lines than for N_2-broadened H_2O lines. Variations in the values of C_s^o / C_{N2}^o are discussed in Sections 3 and 4 for H_2O.

SECTION 2

ABSORPTION BY CH_4 BETWEEN 1100 cm^{-1} AND 1400 cm^{-1}

SAMPLING

The mixtures of $CH_4 + N_2$ were mixed in a 50-liter, glass-lined mixing tank. The CH_4 was first added to the evacuated tank, and the pressure was measured after the gas in the tank had stabilized. The N_2 was then added, and the resulting mixture was stirred by an internal mixer. The internal blade of the mixer was driven through a rotary seal by a hand-held drill motor. The gases were mixed for approximately 30 seconds, and the mixture was allowed to stabilize before the final pressure was measured. Total pressures of the mixtures were typically 10 atm. The concentration of the mixture was calculated by dividing the pressure of the CH_4 by the total pressure of the mixture with a small correction made for the non-linearity in the relationship between the molecular density and the pressure (see Eq. (2)). Two or three separate batches were mixed for each concentration, and the absorption by a few samples from each batch was measured. The results were compared as a check for the consistency of the mixing procedure.

All of the CH_4 samples for which data are reported were contained in one of two sample cells. The cell lengths are 10.2 cm and 0.574 cm. Each cell had two gas lines attached to it. The gas inlet line was attached to the gas-handling manifold; the other line went to the vacuum pump. The valves and manifold system were arranged so that it was convenient to fill the cell and flush it at nearly constant pressure with a pre-mixed sample of gas. The cell could also be evacuated quickly. The sample cells used for the majority of the data were contained in a vacuum tank that was connected directly to the vacuum tank containing the grating monochromator. The optical path external to the sample cell was evacuated to eliminate interference due to absorption by H_2O in the atmosphere. A few of the data were obtained a few years ago with the sample cell in an enclosure that was flushed with dry nitrogen.

A typical sampling procedure consisted of filling the evacuated sample cell from a previously mixed batch to a pressure slightly above the desired final pressure. The gas mixture was then allowed to flush slowly through the cell at a nearly constant pressure for several seconds in order to flush out any small amount of air that might have leaked into the gas-handling system. After the cell was flushed adequately, a portion of the mixture was pumped from the sample cell, leaving the desired final pressure for study. Several checks were made for possible errors introduced by leaks or by adsorption of some of the sample gas on the walls of the sample cell or gas lines. The total pressures and absorber thicknesses listed below for the samples are believed to be accurate to less than $\pm$ 1% and $\pm$ 2%, respectively.

The temperature of the sample cell was measured by a thermometer mounted in good thermal contact with it. The thermometer was read visually through a plexiglass cover on the vacuum tank. Sample cell temperatures varied between

approximately 303 K and 310 K. The cells were not intentionally heated above room temperature; heat from the radiation source and the motor in the vacuum tank increased the internal temperature.

SPECTRAL DATA

All of the CH_4 data except for those in Table 2 are based on spectral curves obtained with the grating spectrometer described previously.[6] The grating used for the CH_4 data contains 75 grooves/mm and is blazed for maximum efficiency at 12 μm. Overlapping orders of shorter wavelength energy were eliminated by an NaCl prism in the beam just ahead of the grating monochromator. The CH_4 data in Table 2 were obtained earlier to determine the intensity of the band by employing a commercial grating monochromator (Perkin-Elmer Model E-1) with the optical path flushed with dry nitrogen. The radiant energy from a Nernst glower in either instrument was chopped at 450 Hz to permit amplification and synchronous demodulation of the signal from the detector, which contains a Ge:Cu element cooled by liquid helium. The dc output of the synchronous demodulator was proportional to the amount of chopped energy incident on the detector and was displayed on a strip-chart recorder. A "background" curve was scanned with the sample cell evacuated, either immediately before or after the sample spectrum was scanned. The spectral curve of transmittance for a sample was obtained by comparing the original curve to the corresponding background curve.

Wavenumber calibration was provided from eleven CH_4 lines and seven H_2O lines of known wavenumber.[7] The CH_4 lines chosen are either unblended, or only slightly blended, so that the positions could be determined with the required accuracy. The H_2O lines were observed by allowing a small amount of air to enter the vacuum tank that contained the sample cell. It was assumed that each spectrum is linear in wavenumber between each two adjacent calibration lines. Throughout most of the spectral region covered in Figs. 1 and 2, the estimated uncertainty in the wavenumber calibration is less than 0.3 cm^{-1}. The spectral slitwidth for the data in these two figures varies from approximately 0.75 cm^{-1} at 1170 cm^{-1} to 1.05 cm^{-1} at 1400 cm^{-1}. This slitwidth is based on a "triangular" slit function and is equal to the width of the triangle at half-maximum transmission.

Figures 1 and 2 show computer-plotted curves of transmittance for eleven representative samples of $CH_4 + N_2$. The important parameters for each sample are given in the figures. Samples 3 and 4 produce the most absorption, and the corresponding curves cover the widest spectral region. The sample pressures have been varied over a wide range up to 1 atm to provide information on the effect of collision broadening.

At the time the data were obtained, the detector noise was greater than normal. As a result, the rms noise on the recorder tracings corresponded to

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[6] D. E. Burch, D. A. Gryvnak, and R. R. Patty. J. Opt. Soc. Am. 57, 885 (1967).

[7] NBS Monograph No. 16 (1959).

between 1% and 2% of the signal observed with the sample cell evacuated. The one-second electronic time constant used to reduce the noise necessitated scanning the spectra slowly to avoid errors in regions of rapidly changing recorder deflection. In addition to uncertainties introduced by the noise, the relatively long time required to scan a spectrum increased the possibility of errors due to slow drift that resulted from variations in the source emittance or in the optical alignment. By carefully comparing a complete spectrum with short regions scanned at separate times for an identical sample, we were able to detect and account for most of the significant errors due to drift. Complete spectra of the different samples were also compared for consistency. Areas of inconsistency were re-checked with new samples, and the appropriate changes were made to each spectrum before it was digitized. The digitizing process smoothed-out some of the noise that appeared on the original records.

One apparent discrepancy that was not found until the data were reduced occurs in the spectrum of Sample 3 in Fig. 2. The transmittance values indicated in the figure between approximately 1310 cm^{-1} and 1365 cm^{-1} would be more accurate if they were multiplied by 0.98. The values at lower wavenumbers, between 1250 cm^{-1} and 1310 cm^{-1}, may also be too high by a slightly smaller amount. This error probably resulted from placing the background curve too low on the sample spectrum. Some of the small structures in the spectra of the extreme wings of the band are uncertain and may be due to impurities in the sample. Except for the errors noted, the values of transmittance indicated by Figs. 1 and 2 are believed to be accurate to $\pm$ 0.02.

Table 1 shows values of the cumulative integrated absorptance for the samples represented in Figs. 1 and 2. Each column corresponds to the sample indicated at the top of the column. The lower and upper limits of integration depend on the amount of absorption by the sample.

In accordance with Eq. (7), the value of $(-1/u) \int \ln T' \, d\nu$ over the spectral region including an entire band system is equal to the intensity of the band system. As discussed in Section 1, immediately below Eq. (7), the value of the integral $\int \ln T' \, d\nu$ is equal to the experimentally measurable quantity $\int \ln T \, d\nu$ when the spectral structure is sufficiently wide relative to the spectral slitwidth. A widely used method of measuring band intensities involves measuring the transmittance T for a sample at high pressures so that the individual absorption lines are collision broadened to a width comparable to the spectral slitwidth. Table 2 summarizes the results of such a measurement on a $CH_4 + N_2$ sample at a total pressure of 10 atm and the absorber thickness equal to 6.93×10^{18} molecules/cm^2. At this high sample pressure, the lines are broadened so that the transmittance T observed with a 0.8 cm^{-1} spectral slitwidth is approximately equal to the true transmittance T' that would be observed with infinite resolving power. The value of absorber thickness is sufficiently large to produce measurable absorption throughout most of the band while not producing too much absorption in the strongest portions to be measured accurately. If the transmittance is too low, $-\ln T$ can not be measured accurately. The results in Table 2 are consistent with results not included that were obtained for other high-pressure samples with different absorber thicknesses.

The combined intensity of all of the lines within a spectral interval is approximately equal to the difference between the two values of the cumulative integral listed in Table 2 for the two wavenumbers bounding the integral. Some allowance must be made for the finite slitwidth and for the contributions by wings of lines. For example, all of the contribution by a line may not be included if its center occurs in the spectral interval of interest but its wings extend outside the interval. The opposite effect results from the extreme wings of lines centered just outside of the interval.

The intensity measured for the entire band system is $574 \pm 25 \times 10^{-20}$ $molecules^{-1}\ cm^2\ cm^{-1}$. This value compares favorably with the previously published values listed in Table 3 below.

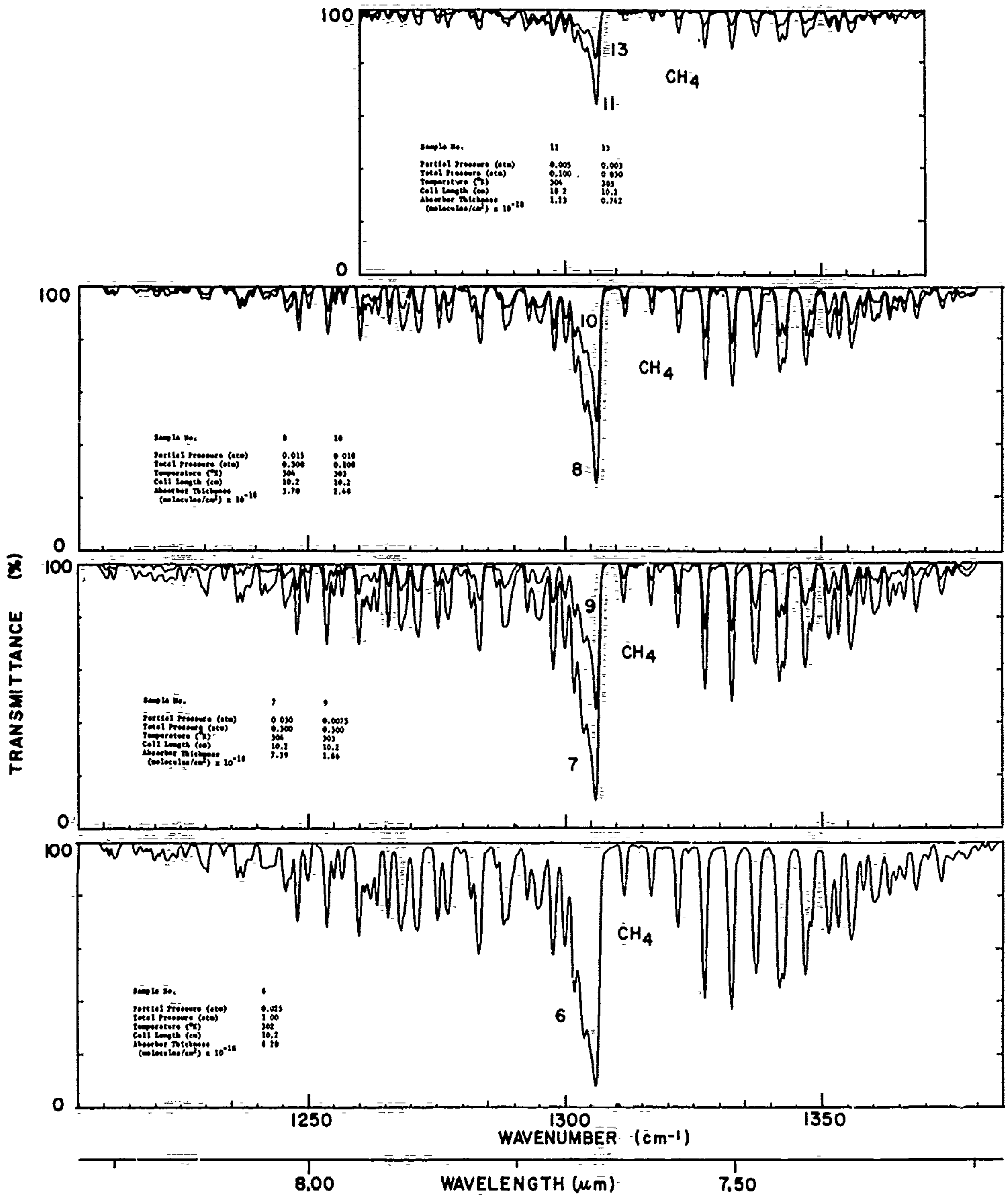

Figure 1. Spectral curves of transmittance of seven CH_4 samples.

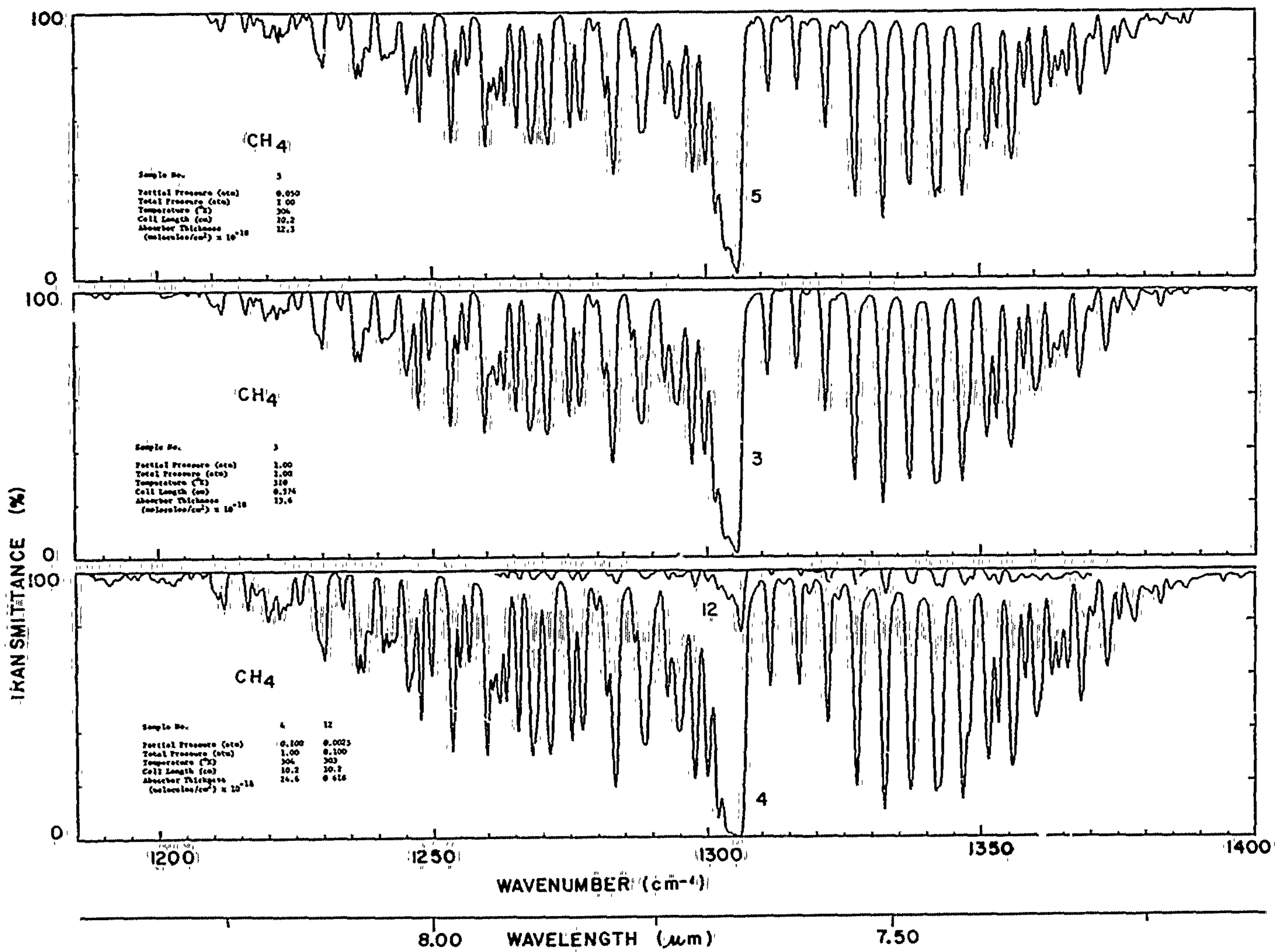

Figure 2. Spectral curves of transmittance of four CH_4 samples.

Table I $\int_{\nu'}^{\nu} (1-T)\, d\nu$

Sample No.	3	4	5	6	7	8	9	10
p (atm)	1.00	0.100	0.050	0.025	0.030	0.015	0.0075	0.010
P (atm)	1.00	1.00	1.00	1.00	0.300	0.300	0.300	0.100
Temperature (°K)	310	304	304	302	304	304	303	302
Cell Length (cm)	0.574	10.2	10.2	10.2	10.2	10.2	10.2	10.2
u(molecules/cm²) x 10^{-18}	13.6	24.6	12.3	6.20	7.39	3.70	1.86	2.48
ν (cm^{-1})								
1185.00	0.	0.						
1186.00	0.	0.						
1187.00	0.	0.						
1188.00	0.000	0.004						
1189.00	0.008	0.022						
1190.00	0.018	0.042						
1191.00	0.030	0.074						
1192.00	0.046	0.115						
1193.00	0.049	0.141						
1194.00	0.054	0.156						
1195.00	0.055	0.168						
1196.00	0.056	0.183						
1197.00	0.057	0.202						
1198.00	0.058	0.204						
1199.00	0.059	0.220						
1200.00	0.060	0.249						
1201.00	0.065	0.273						
1202.00	0.082	0.309						
1203.00	0.096	0.354						
1204.00	0.103	0.385						
1205.00	0.105	0.398						
1206.00	0.115	0.411						
1207.00	0.117	0.418						
1208.00	0.126	0.425						
1209.00	0.129	0.439						
1210.00	0.155	0.468	0.016	0.017	0.020	0.004	0.003	0.001
1211.00	0.200	0.556	0.045	0.046	0.066	0.029	0.020	0.018
1212.00	0.273	0.663	0.095	0.088	0.104	0.055	0.034	0.037
1213.00	0.295	0.720	0.119	0.130	0.130	0.071	0.044	0.049
1214.00	0.296	0.725	0.119	0.135	0.133	0.071	0.045	0.049
1215.00	0.296	0.730	0.119	0.135	0.134	0.072	0.046	0.048
1216.00	0.323	0.762	0.133	0.142	0.160	0.079	0.046	0.047
1217.00	0.381	0.868	0.188	0.175	0.193	0.099	0.051	0.046
1218.00	0.416	0.938	0.204	0.199	0.231	0.116	0.057	0.045
1219.00	0.445	1.009	0.227	0.226	0.271	0.120	0.062	0.043
1220.00	0.520	1.130	0.274	0.269	0.317	0.151	0.071	0.047
1221.00	0.601	1.284	0.359	0.319	0.368	0.181	0.080	0.062
1222.00	0.672	1.397	0.418	0.354	0.417	0.200	0.093	0.069
1223.00	0.742	1.545	0.508	0.417	0.477	0.231	0.119	0.083
1224.00	0.814	1.675	0.575	0.463	0.531	0.256	0.139	0.103
1225.00	0.833	1.746	0.604	0.497	0.563	0.268	0.146	0.111
1226.00	0.888	1.835	0.644	0.530	0.606	0.298	0.148	0.121
1227.00	0.909	1.896	0.661	0.556	0.630	0.304	0.149	0.133
1228.00	0.911	1.910	0.679	0.561	0.659	0.308	0.149	0.135
1229.00	0.984	2.018	0.740	0.597	0.687	0.335	0.155	0.146
1230.00	1.153	2.286	0.980	0.685	0.778	0.388	0.171	0.174
1231.00	1.280	2.520	1.030	0.759	0.859	0.415	0.184	0.194
1232.00	1.245	2.546	1.031	0.761	0.873	0.418	0.185	0.199
1233.00	1.289	2.559	1.035	0.769	0.881	0.418	0.186	0.200
1234.00	1.343	2.665	1.086	0.803	0.926	0.439	0.193	0.207
1235.00	1.353	2.691	1.098	0.815	0.940	0.442	0.200	0.220
1236.00	1.439	2.792	1.169	0.849	0.973	0.470	0.214	0.249
1237.00	1.681	3.139	1.388	0.957	1.090	0.540	0.243	0.306
1238.00	1.882	3.458	1.580	1.061	1.209	0.600	0.270	0.352
1239.00	2.018	3.605	1.714	1.123	1.298	0.632	0.282	0.370
1240.00	2.047	3.750	1.735	1.143	1.313	0.642	0.284	0.377
1241.00	2.158	3.891	1.815	1.187	1.365	0.667	0.295	0.388
1242.00	2.329	4.156	1.981	1.282	1.459	0.710	0.321	0.411
1243.00	2.499	4.422	2.136	1.369	1.556	0.744	0.348	0.431
1244.00	2.685	4.613	2.256	1.441	1.623	0.773	0.369	0.443
1245.00	2.676	4.705	2.318	1.476	1.656	0.783	0.377	0.454
1246.00	2.963	5.115	2.502	1.632	1.794	0.866	0.418	0.504
1247.00	3.154	5.430	2.780	1.758	1.899	0.927	0.446	0.537
1248.00	3.473	5.818	3.045	1.936	2.059	1.029	0.508	0.605
1249.00	3.588	5.999	3.191	2.045	2.146	1.082	0.535	0.650
1250.00	3.787	6.290	3.360	2.145	2.239	1.138	0.556	0.681
1251.00	3.843	6.411	3.448	2.196	2.282	1.167	0.569	0.700
1252.00	3.847	5.435	3.459	2.204	2.291	1.168	0.569	0.702
1253.00	3.927	6.540	3.525	2.243	2.324	1.182	0.571	0.705
1254.00	4.350	7.100	3.919	2.482	2.559	1.322	0.646	0.777
1255.00	4.558	7.411	4.113	2.605	2.666	1.379	0.683	0.809
1256.00	4.663	7.597	4.229	2.676	2.729	1.406	0.703	0.825
1257.00	4.830	7.868	4.369	2.752	2.816	1.446	0.725	0.852
1258.00	4.866	7.947	4.430	2.815	2.838	1.457	0.732	0.860
1259.00	4.898	8.018	4.472	2.836	2.858	1.460	0.734	0.862

Table I $\int_{\nu'}^{\nu}(1-T)\,d\nu$ (cont'd)

Sample No.	3	4	5	6	7	8	9	10	11	12	13
p (atm)	1.0	0.100	0.050	0.025	0.030	0.015	0.0075	0.010	0.005	0.0025	0.003
P (atm)	1.00	1.00	1.00	1.00	0.300	0.300	0.300	0.100	0.100	0.100	0.030
Temperature (°K)	310	304	304	302	304	304	303	302	304	303	303
Cell Length (cm)	0.574	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2
u (molecules/cm²) x 10⁻¹⁸	13.6	24.6	12.3	6.20	7.39	3.70	1.86	2.48	1.23	0.618	0.742
ν (cm^{-1})											
1260.00	5.282	8.403	4.839	3.052	3.053	1.574	0.801	0.922	0.	0.	0.
1261.00	5.623	8.954	5.149	3.257	3.232	1.601	0.866	0.974	0.020	0.017	0.014
1262.00	5.931	9.376	5.428	3.429	3.371	1.753	0.913	1.012	0.050	0.031	0.022
1263.00	6.216	9.783	5.686	3.602	3.542	1.823	0.965	1.057	0.078	0.047	0.042
1264.00	6.495	10.177	5.949	3.782	3.641	1.904	1.020	1.098	0.103	0.067	0.052
1265.00	6.590	10.322	6.038	3.832	3.669	1.910	1.035	1.106	0.106	0.075	0.052
1266.00	6.952	10.812	6.385	4.051	3.851	2.013	1.103	1.162	0.131	0.098	0.071
1267.00	7.024	10.957	6.468	4.109	3.892	2.034	1.119	1.179	0.142	0.104	0.074
1268.00	7.373	11.362	6.773	4.307	4.020	2.107	1.172	1.219	0.157	0.119	0.083
1269.00	7.846	11.998	7.213	4.596	4.242	2.255	1.259	1.295	0.197	0.148	0.105
1270.00	8.020	12.294	7.383	4.713	4.329	2.311	1.286	1.315	0.202	0.160	0.112
1271.00	8.359	12.679	7.679	4.902	4.457	2.384	1.331	1.346	0.223	0.170	0.120
1272.00	8.822	13.310	8.101	5.201	4.704	2.541	1.426	1.436	0.273	0.198	0.143
1273.00	8.892	13.463	8.169	5.264	4.749	2.564	1.442	1.449	0.279	0.206	0.145
1274.00	8.986	13.517	8.190	5.282	4.754	2.564	1.443	1.449	0.279	0.207	0.145
1275.00	9.067	13.736	8.361	5.378	4.821	2.591	1.467	1.469	0.293	0.216	0.152
1276.00	9.418	14.257	8.686	5.603	4.999	2.702	1.533	1.538	0.332	0.240	0.171
1277.00	9.682	14.610	8.932	5.750	5.114	2.765	1.568	1.574	0.359	0.255	0.177
1278.00	10.025	15.114	9.247	5.974	5.207	2.879	1.630	1.632	0.401	0.281	0.191
1279.00	10.067	15.227	9.295	6.015	5.314	2.892	1.640	1.640	0.409	0.287	0.196
1280.00	10.120	15.349	9.353	6.049	5.352	2.903	1.645	1.655	0.411	0.290	0.203
1281.00	10.182	15.475	9.418	6.086	5.384	2.923	1.654	1.662	0.415	0.294	0.204
1282.00	10.462	15.858	9.680	6.250	5.510	2.991	1.691	1.700	0.437	0.305	0.209
1283.00	10.890	16.392	10.054	6.486	5.687	3.096	1.754	1.763	0.474	0.327	0.222
1284.00	11.383	17.075	10.537	6.834	5.960	3.271	1.876	1.868	0.535	0.367	0.260
1285.00	11.451	17.241	10.606	6.892	5.993	3.287	1.889	1.893	0.537	0.375	0.267
1286.00	11.477	17.315	10.642	6.914	6.006	3.287	1.889	1.895	0.539	0.377	0.276
1287.00	11.621	17.521	10.773	6.986	6.069	3.312	1.905	1.916	0.554	0.380	0.284
1288.00	11.925	17.890	11.051	7.144	6.199	3.385	1.948	1.959	0.581	0.391	0.301
1289.00	12.406	18.536	11.499	7.441	6.433	3.536	2.034	2.036	0.632	0.419	0.334
1290.00	12.683	18.973	11.765	7.616	6.565	3.625	2.002	2.092	0.667	0.439	0.361
1291.00	12.764	19.151	11.860	7.677	6.605	3.650	2.096	2.113	0.679	0.446	0.373
1292.00	12.820	19.257	11.926	7.711	6.621	3.662	2.100	2.131	0.682	0.448	0.394
1293.00	13.103	19.630	12.196	7.873	6.759	3.751	2.150	2.193	0.715	0.470	0.462
1294.00	13.338	19.988	12.408	7.994	6.865	3.822	2.186	2.242	0.736	0.486	0.504
1295.00	13.730	20.545	12.784	8.217	7.059	3.941	2.250	2.313	0.775	0.508	0.550
1296.00	14.073	21.056	13.094	8.410	7.230	4.047	2.310	2.389	0.808	0.527	0.580
1297.00	14.266	21.342	13.265	8.507	7.307	4.084	2.335	2.412	0.820	0.534	0.629
1298.00	14.821	22.007	13.786	8.863	7.630	4.274	2.457	2.538	0.887	0.578	0.713
1299.00	15.109	22.463	14.045	9.032	7.766	4.369	2.503	2.597	0.915	0.595	0.763
1300.00	15.582	23.005	14.465	9.296	7.984	4.502	2.580	2.674	0.964	0.613	0.785
1301.00	16.041	23.648	14.885	9.571	8.204	4.650	2.663	2.763	1.006	0.639	0.818
1302.00	16.726	24.394	15.531	10.016	8.595	4.888	2.810	2.917	1.094	0.686	0.863
1303.00	17.599	25.280	16.258	10.538	9.019	5.182	2.989	3.088	1.185	0.751	0.920
1304.00	18.429	26.253	17.141	11.241	9.634	5.619	3.267	3.327	1.329	0.848	1.000
1305.00	19.369	27.244	18.051	11.979	10.298	6.082	3.565	3.606	1.493	0.950	1.082
1306.00	20.346	28.241	19.018	12.844	11.115	6.722	4.008	4.019	1.769	1.115	1.225
1307.00	21.044	29.100	19.694	13.480	11.642	7.219	4.343	4.333	1.988	1.264	1.335
1308.00	21.159	29.335	19.803	13.557	11.667	7.253	4.358	4.352	1.994	1.269	1.344
1309.00	21.197	29.425	19.850	13.582	11.669	7.263	4.361	4.356	1.994	1.269	1.347
1310.00	21.216	29.478	19.878	13.598	11.669	7.265	4.363	4.359	1.994	1.270	1.350
1311.00	21.289	29.578	19.948	13.626	11.691	7.281	4.370	4.371	2.003	1.272	1.352
1312.00	21.543	29.932	20.191	13.786	11.800	7.366	4.416	4.416	2.031	1.285	1.363
1313.00	21.567	30.002	20.230	13.815	11.814	7.377	4.425	4.425	2.041	1.287	1.367
1314.00	21.575	30.052	20.263	13.828	11.830	7.388	4.431	4.429	2.043	1.288	1.375
1315.00	21.577	30.100	20.293	13.845	11.837	7.384	4.433	4.431	2.047	1.289	1.380
1316.00	21.589	30.158	20.325	13.866	11.845	7.385	4.437	4.435	2.048	1.290	1.381
1317.00	21.815	30.481	20.551	14.004	11.958	7.450	4.480	4.477	2.066	1.299	1.388
1318.00	21.877	30.619	20.631	14.061	11.981	7.478	4.497	4.489	2.080	1.307	1.392
1319.00	21.894	30.693	20.680	14.083	12.007	7.494	4.502	4.498	2.085	1.312	1.403
1320.00	21.897	30.747	20.713	14.102	12.016	7.500	4.504	4.499	2.088	1.319	1.410
1321.00	21.989	30.812	20.756	14.125	12.025	7.503	4.507	4.506	2.089	1.327	1.411
1322.00	22.190	31.168	21.053	14.310	12.165	7.588	4.563	4.567	2.119	1.346	1.423
1323.00	22.406	31.476	21.251	14.457	12.260	7.676	4.618	4.616	2.164	1.373	1.444
1324.00	22.449	31.582	21.315	14.487	12.287	7.690	4.620	4.627	2.166	1.376	1.447
1325.00	22.472	31.666	21.366	14.512	12.304	7.703	4.620	4.642	2.171	1.378	1.449
1326.00	22.508	31.747	21.423	14.535	12.314	7.713	4.620	4.649	2.177	1.380	1.449
1327.00	22.812	32.113	21.734	14.784	12.469	7.804	4.679	4.715	2.206	1.397	1.478
1328.00	23.362	32.768	22.254	15.182	12.801	8.072	4.856	4.858	2.307	1.450	1.517
1329.00	23.456	32.931	22.350	15.227	12.827	8.100	4.867	4.868	2.321	1.470	1.523

Table I $\int_{\nu'}^{\nu}(1-T)\,d\nu$ (cont'd)

Sample No.	3	4	5	6	7	8	9	10	11	12	13
p (atm)	1.00	0.100	0.050	0.025	0.030	0.015	0.0075	0.010	0.005	0.0025	0.003
P (atm)	1.00	1.00	1.00	1.00	0.300	0.300	0.300	0.100	0.100	0.100	0.030
Temperature ($^{\circ}$K)	310	304	304	302	304	304	303	302	304	303	305
Cell Length (cm)	0.574	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2
u(molecules/cm^2) $\times 10^{-18}$	13.6	24.6	12.3	6.20	7.39	3.70	1.86	2.48	1.23	0.618	0.742
(cm^{-1})											
1330.00	23.496	33.026	22.405	15.240	12.841	8.121	4.869	4.883	2.324	1.474	1.527
1331.00	23.531	33.114	22.459	15.268	12.852	8.128	4.870	4.893	2.328	1.475	1.527
1332.00	23.815	33.494	22.753	15.425	12.982	8.197	4.922	4.943	2.358	1.487	1.542
1333.00	24.913	34.284	23.408	16.008	13.403	8.515	5.126	5.113	2.465	1.560	1.590
1334.00	24.686	34.521	23.551	16.100	13.461	8.578	5.148	5.143	2.493	1.578	1.602
1335.00	24.728	34.625	23.601	16.126	13.479	8.587	5.149	5.145	2.495	1.571	1.603
1336.00	24.784	34.743	23.674	16.157	13.496	8.601	5.151	5.149	2.502	1.571	1.603
1337.00	25.203	35.323	24.114	16.443	13.752	8.735	5.248	5.238	2.552	1.600	1.631
1338.00	25.806	36.002	24.655	16.851	14.040	8.961	5.381	5.363	2.625	1.650	1.671
1339.00	25.941	36.185	24.774	16.919	14.086	9.010	5.394	5.384	2.638	1.550	1.678
1340.00	25.995	36.304	24.828	16.944	14.113	9.033	5.394	5.391	2.641	1.659	1.683
1341.00	26.109	36.524	24.950	17.012	14.152	9.065	5.407	5.406	2.654	1.668	1.691
1342.00	26.694	37.249	25.538	17.450	14.504	9.310	5.567	5.539	2.735	1.713	1.738
1343.00	27.395	38.025	26.190	17.943	14.830	9.587	5.738	5.698	2.833	1.774	1.786
1344.00	27.666	38.306	26.415	18.086	14.987	9.688	5.781	5.762	2.878	1.795	1.803
1345.00	27.720	38.420	26.484	18.116	15.004	9.701	5.784	5.773	2.880	1.796	1.803
1346.00	27.838	38.651	26.619	18.191	15.049	9.735	5.800	5.799	2.887	1.801	1.805
1347.00	28.436	39.409	27.183	18.597	15.372	9.962	5.930	5.929	2.964	1.844	1.843
1348.00	28.970	40.047	27.679	18.939	15.631	10.161	6.044	6.043	3.036	1.887	1.877
1349.00	29.213	40.328	27.914	19.096	15.751	10.265	6.090	6.101	3.078	1.912	1.895
1350.00	29.259	40.434	27.968	19.130	15.768	10.257	6.095	6.113	3.084	1.913	1.897
1351.00	29.504	40.820	28.205	19.282	15.889	10.350	6.137	6.172	3.102	1.929	1.908
1352.00	29.993	41.458	28.654	19.577	16.134	10.517	6.232	6.256	3.152	1.966	1.940
1353.00	30.324	41.878	28.946	19.776	16.279	10.629	6.287	6.303	3.186	1.999	1.965
1354.00	30.611	42.248	29.236	19.971	16.430	10.753	6.354	6.372	3.230	2.038	2.003
1355.00	30.749	42.448	29.361	20.052	16.480	10.794	6.369	6.414	3.244	2.049	2.025
1356.00	31.288	43.108	29.846	20.378	16.765	10.992	6.469	6.538	3.318	2.091	2.067
1357.00	31.646	43.637	30.198	20.621	16.936	11.131	6.524	6.622	3.361	2.130	2.093
1358.00	31.839	43.880	30.374	20.710	17.020	11.198	6.552	6.677	3.377	2.158	2.116
1359.00	32.005	44.133	30.558	20.823	17.101	11.266	6.586	6.716	3.395	2.191	2.137
1360.00	32.270	44.521	30.771	20.964	17.208	11.353	6.629	6.749	3.419	2.219	2.158
1361.00	32.629	45.035	31.113	21.179	17.367	11.467	6.693	6.803	3.438	2.259	2.177
1362.00	32.779	45.275	31.271	21.294	17.464	11.524	6.726	6.835	3.449	2.289	2.190
1363.00	32.987	45.550	31.452	21.413	17.539	11.597	6.771	6.878	3.465	2.321	2.199
1364.00	33.218	45.878	31.668	21.553	17.651	11.680	6.816	6.942	3.488	2.361	2.212
1365.00	33.425	46.191	31.864	21.673	17.749	11.746	6.851	6.985	3.515	2.396	2.228
1366.00	33.637	46.511	32.068	21.791	17.849	11.818	6.893	7.030	3.538	2.419	2.234
1367.00	33.727	46.673	32.176	21.865	17.901	11.854	6.912	7.059	3.555	2.439	2.234
1368.00	33.883	46.896	32.329	21.947	17.957	11.905	6.937	7.091	3.567	2.458	2.243
1369.00	34.156	47.324	32.599	22.098	18.186	11.998	6.977	7.153	3.591	2.495	2.253
1370.00	34.260	47.521	32.720	22.159	18.160	12.035	7.000	7.170	3.598	2.521	2.255
1371.00	34.338	47.685	32.821	22.214	18.203	12.058	7.018	7.195			
1372.00	34.356	47.749	32.866	22.233	18.218	12.061	7.021	7.209			
1373.00	34.510	47.995	33.046	22.319	18.274	12.105	7.053	7.236			
1374.00	34.673	48.271	33.224	22.426	18.367	12.162	7.099	7.283			
1375.00	34.727	48.394	33.306	22.483	18.398	12.186	7.119	7.303			
1376.00	34.788	48.538	33.391	22.542	18.435	12.224	7.143	7.320			
1377.00	34.812	48.634	33.445	22.582	18.456	12.257	7.152	7.338			
1378.00	34.877	48.807	33.544	22.634	18.508	12.289	7.170	7.362			
1379.00	34.941	48.952	33.629	22.681	18.543	12.313	7.193	7.394			
1380.00	34.952	49.027	33.667	22.701	18.561	12.325	7.196	7.411			
1381.00	34.972	49.116	33.694	22.722	18.561	12.325	7.196	7.411			
1382.00	34.992	49.198	33.733	22.736	18.561	12.325	7.196	7.411			
1383.00	35.035	49.310	33.782	22.758	18.561	12.325	7.196	7.411			
1384.00	35.068	49.382	33.819	22.771	18.561	12.325	7.196	7.412			
1385.00	35.087	49.455	33.846	22.772	18.561	12.325	7.196	7.412			
1386.00	35.099	49.515	33.882	22.772							
1387.00	35.106	49.576	33.928	22.772							
1388.00	35.128	49.650	33.967	22.772							
1389.00	35.133	49.698	33.991	22.772							
1390.00	35.140	49.740	33.991	22.772							
1391.00	35.141	49.774	33.991	22.772							
1392.00	35.142	49.805	33.991	22.772							
1393.00	35.145	49.835	33.991	22.772							
1394.00	35.149	49.868	33.991	22.772							
1395.00	35.161	49.912	33.991	22.772							
1396.00	35.163	49.938	33.991	22.772							
1397.00	35.167	49.968	33.991	22.772							
1398.00	35.169	50.007	33.991	22.772							
1399.00	35.179	50.032	33.991	22.772							
1400.00	35.188	50.056	33.991	22.772							

TABLE 2 $\frac{1}{u}\int_{\nu'}^{\nu} -\ell n T \, d\nu$ FOR CH_4

(Multiply all integral values by 10^{-20} molecules^{-1} cm^2 cm^{-1})

ν (cm^{-1})	$-\frac{1}{u}\int_{\nu'}^{\nu} -\ell n T \, d\nu$	ν (cm^{-1})	$-\frac{1}{u}\int_{\nu'}^{\nu} -\ell n T \, d\nu$
1210	0.72	1285	151.6
1215	3.04	1290	167.9
1220	6.17	1295	181.3
1225	10.54	1300	207.3
1230	14.26	1305	288.1
1235	18.23	1310	350.4
1240	25.73	1315	358.9
1245	33.19	1320	366.0
1250	47.26	1325	376.8
1255	57.63	1330	399.1
1260	68.58	1335	426.3
1265	86.30	1340	447.5
1270	104.9	1345	478.3
1275	120.8	1350	502.8
1280	134.6	1355	524.0

$\nu' = 1205$ cm^{-1}

When the wings of the band are included in the integral, the value becomes $574 \pm 25 \times 10^{-20}$ molecules^{-1} cm^2 cm^{-1}, which is equal to the value of the intensity of the entire band system.

TABLE 3. COMPARISON OF EXPERIMENTAL VALUES OF BAND INTENSITY

Reference	$(-1/u)\int \ln T\, d\nu$ (molecules^{-1} cm^{2} cm^{-1})
Rollefson and Havens[8]	551×10^{20}
Thorndike[9]	558×10^{20}
Welsh and Sandiford[10]	585×10^{20}
Armstrong and Welsh[11]	588×10^{20}
Present Investigation	574×10^{20}

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8. R. Rollefson and R. Havens, Phys. Rev. 57, 710 (1940).

9. A. M. Thorndike, J. Chem. Phys. 15, 868 (1947).

10. H. L. Welsh and P. J. Sandiford, J. Chem. Phys. 20, 1646 (1952).

11. R. K. Armstrong and H. L. Welsh, Spectrochimica Acta 16, 840 (1960).

SECTION 3

CONTINUUM ABSORPTION BY H_2O BETWEEN 600 cm^{-1} AND 1300 cm^{-1}

The absorption by H_2O in the atmospheric window between approximately 800 cm^{-1} and 1200 cm^{-1} is different from that in most regions because a significant portion of it is due to continuum absorption. Although many very weak H_2O lines are centered in this region, the contribution by these lines in a typical lower atmospheric path is much less than that by the continuum. Some of the continuum absorption is undoubtedly due to the extreme wings of strong H_2O lines centered outside of the 800 - 1200 cm^{-1} interval. Dimers formed by the association of two H_2O molecules ($H_2O:H_2O$) may also contribute to the continuum absorption. For purposes of calculating the attenuation by atmospheric paths it is not important that the absorbing mechanism be understood completely as long as the absorption coefficients at different wavenumbers are determined for temperatures and pressures of interest. As explained in Section 1, the attenuation over a given path length varies as the square of the H_2O partial pressure whether the absorption is due to dimers or to the extreme wings of self-broadened H_2O lines.

Within the 600 - 1300 cm^{-1} region there are several narrow intervals as wide as approximately 1 cm^{-1} at which the influence of lines closer than a few cm^{-1} is much less than that by the continuum absorption. Throughout much of the more transparent part of the window between 800 cm^{-1} and 1200 cm^{-1}, there is probably little contribution by all of the lines centered closer than 30 - 50 cm^{-1} to many of these narrow intervals between very weak nearby lines. Lines centered in the edges of the window from 600 cm^{-1} to 800 cm^{-1} and from 1200 cm^{-1} to 1300 cm^{-1} are stronger than those in the center of the window. Consequently, nearby lines can make a significant contribution to the absorption in the narrow, clean intervals in these edges of the window. Nevertheless, the continuum still plays a very important role in these intervals.

In 1970 we published a report[2] that included data on the H_2O continuum absorption throughout the 700 - 1250 cm^{-1} region. The continuum absorption was determined by measuring the absorption in several of the narrow, clean intervals discussed in the previous paragraph. The absorption was measured from spectral curves of transmittance scanned with a spectral slitwidth of less than 0.5 cm^{-1}. By making a small allowance for a few nearby lines, the continuum was determined for samples at different pressures and temperatures. Values of the continuum absorption coefficient C_s^o (see Eq. (10)) for self-broadening were determined and published for three temperatures: 296 K, 358 K and 388 K. Attempts to measure the nitrogen broadening coefficient C_{N2}^o as part of the same experiment were unsuccessful because of the very weak dependence of the continuum absorption on the pressure of N_2. However, the results did indicate that near room temperature the ratio C_{N2}^o/C_s^o is less than 0.005.

Since publishing these original data on the 700 - 1200 cm^{-1} region, we have investigated the continuum absorption in other spectral regions and have

improved some of our experimental techniques. Because of the importance of the 700 - 1250 cm^{-1} region, we have re-investigated the continuum absorption while employing some of our improved techniques, particularly those related to interference by contaminants in the sample. As a result of the more recent measurements, we have concluded that the previously published values of C_s^o were probably too high by 5% to 20%. The highest percentage error is between 1000 cm^{-1} and 1200 cm^{-1} where absorption by contaminants was the most serious. This amount of discrepancy between two separate measurements is believed to be quite good in view of the difficulty of the experiment.

Figure 3 summarizes the results of the later measurements. The uncertainty in the results is difficult to estimate because of the possibility of some systematic experimental error that is not identified. However, we believe that any of the values represented by the 296 K curve are in error by less than $\pm$ 15%, and those for the two elevated temperatures, 392 K and 430 K, by less than $\pm$ 10%. The large decrease in C_s^o with increasing temperature is consistent with the previous data.

At 392 K, C_s^o increases rapidly with increasing wavenumber above approximately 1150 cm^{-1}. The intensities of the H_2O lines centered in or near the 1150 cm^{-1} - 1300 cm^{-1} region increase rapidly with increasing temperature because the lower energy levels involved in the transitions are excited. The populations of these energy levels therefore increase rapidly with temperature. The increase in C_s^o is a result of the increasing contribution by the lines centered above 1150 cm^{-1}. The contribution by these same lines is apparently small for wavenumbers less than 1100 cm^{-1}. A large portion of the continuum below 1100 cm^{-1} is probably due to the extreme wings of the very strong lines centered below 600 cm^{-1}. This could account for the increasing C_s^o with decreasing wavenumber below 1100 cm^{-1} as the point of observation approaches these strong lines.

Since being published, the 1970 data[2] have been used widely to predict atmospheric absorption and have been compared with results of a variety of experiments. The more recent data illustrated in Figure 3 have also been made available to a few workers interested in developing accurate transmission models. Among these workers are Roberts, Selby and Biberman,[12] who have summarized the results of several field measurements and laboratory measurements designed to provide new and better information on the H_2O continuum absorption. Roberts, et al., have arrived at what they believe is the best model for continuum absorption based on the variety of data they have accumulated. Their model is in essential agreement with Fig. 3 for 296 K.

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[12] R. E. Roberts J. E. A. Selby and L. M. Biberman, Appl. Opt. 15, 2085 (1976).

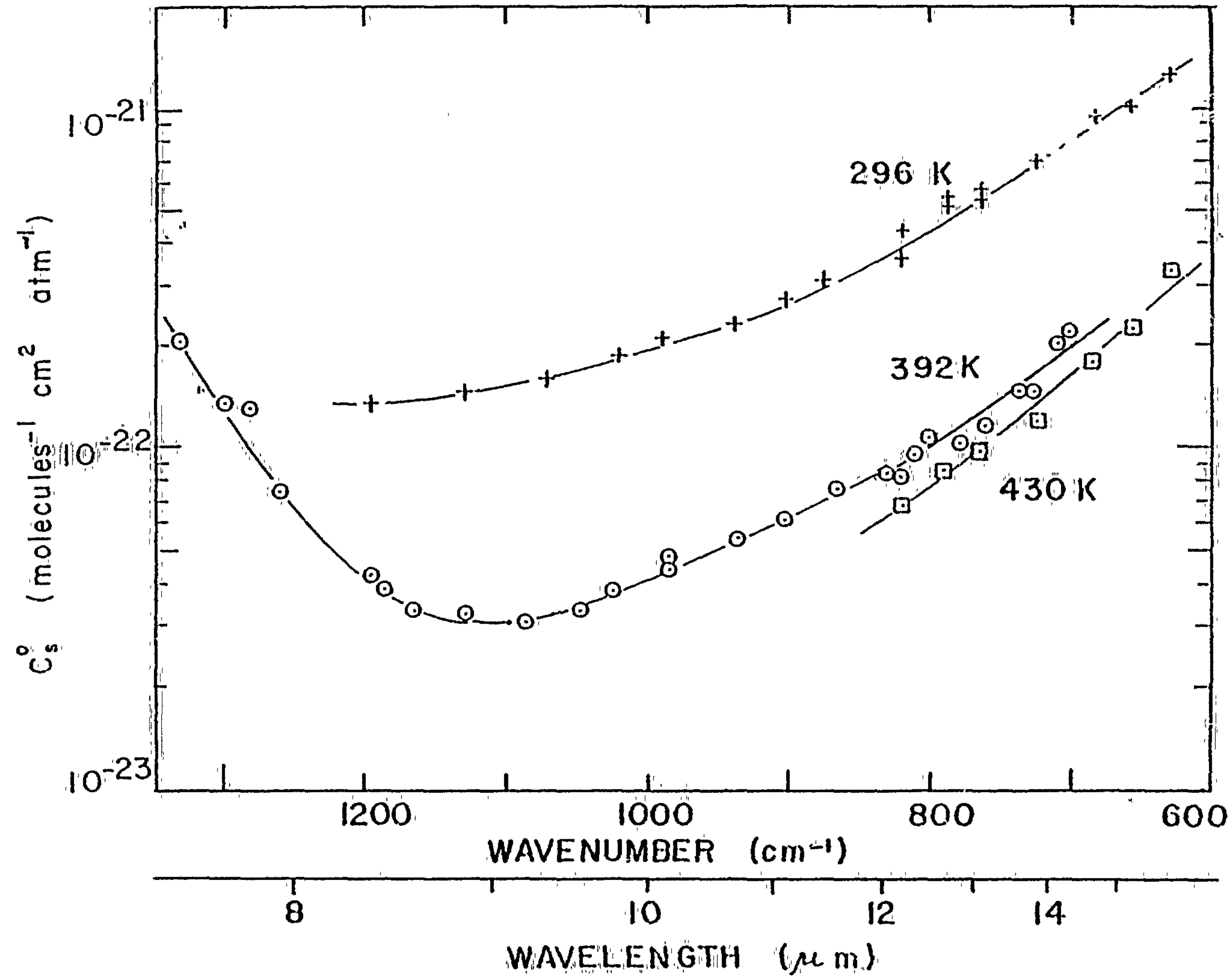


Figure 3. Spectral plot of C_s^o between 600 cm^{-1} and 1300 cm^{-1}

SECTION 4

ABSORPTION BY H_2O BETWEEN 333 cm^{-1} AND 444 cm^{-1}

EXPERIMENTAL

The H_2O absorption data presented in this section were obtained in the same manner as the H_2O data reported previously by us in several reports. The longer of two multiple-pass cells in our laboratory was used for path lengths of 123 meters or greater; a shorter multiple-pass cell served for paths up to 28.84 meters. A custom-made grating monochromator employing a liquid-helium-cooled Ge:Cu detector was used to scan spectral curves of transmittance and to isolate very narrow spectral intervals for detailed study. Essentially all of the optical path outside of the sample cell was confined to two vacuum tanks to eliminate absorption by atmospheric gases. The only exception was a path of a few cm between the globar energy source and a window to one of the vacuum tanks. This short path was flushed with dry N_2. Polyethylene windows were used on the sample cells and on the vacuum tank where the energy beam entered from the globar source. The detector contained a KRS-5 window.

The grating used for the data in this section contains 45 lines/mm and is blazed at 22 μm. A long-pass interference filter eliminated overlapping orders of higher-wavenumber energy passed by the grating monochromator. Detector signals were processed with a synchronous demodulator and amplifier, and the dc output of the amplifier was displayed on a strip-chart recorder. Transmittances were determined by dividing the signal output observed with the sample in place to that observed with the sample cell evacuated.

All sample pressures below approximately 0.08 atm were measured with an oil manometer; higher pressures were measured with an Hg manometer. Mixtures of $H_2O + N_2$ were formed by first adding the H_2O to the evacuated sample cell and allowing the gas to stabilize before measuring its pressure. The N_2 was then added slowly, allowing it to mix with the H_2O. Table 4 summarizes the important parameters of the samples for which detailed spectral data are presented. Absorption by several other samples not listed was investigated at certain wavenumbers of interest without scanning the spectra. The H_2O partial pressure p and the total pressure P are given in the second and third columns; all samples were either pure H_2O or $H_2O + N_2$. The absorber thickness u shown in the fifth column is expressed in molecules/cm^2 and is related to the other sample parameters by Eq. (1). The number associated with u has been abbreviated: for example, 169. +20 denotes 169 x 10^{20} molecules/cm^2.

The final three columns of Table 4 give the resolution schedule, the region over which spectra have been scanned, and the number of the figure in which the spectrum appears. Table 5 lists the spectral slitwidth corresponding to the resolution schedules given in Table 4. Spectral slitwidths given in Table 5 correspond to the full width at half-maximum of a triangular slit function.

RESULTS

Figures 4 through 9 shows the computer-plotted spectra for the samples represented in Table 4. The important sample parameters are repeated in each figure. The original recorder tracings have been smoothed somewhat during the digitizing process; thus the original noise level was higher than that indicated by the computer-plotted curves in Figures 4 through 9. The estimated errors in the plotted values of transmittance vary from less than 0.02 near 440 cm^{-1} to 0.03 near 330 cm^{-1}. At points where T is near zero or near unity, the errors are probably lower.

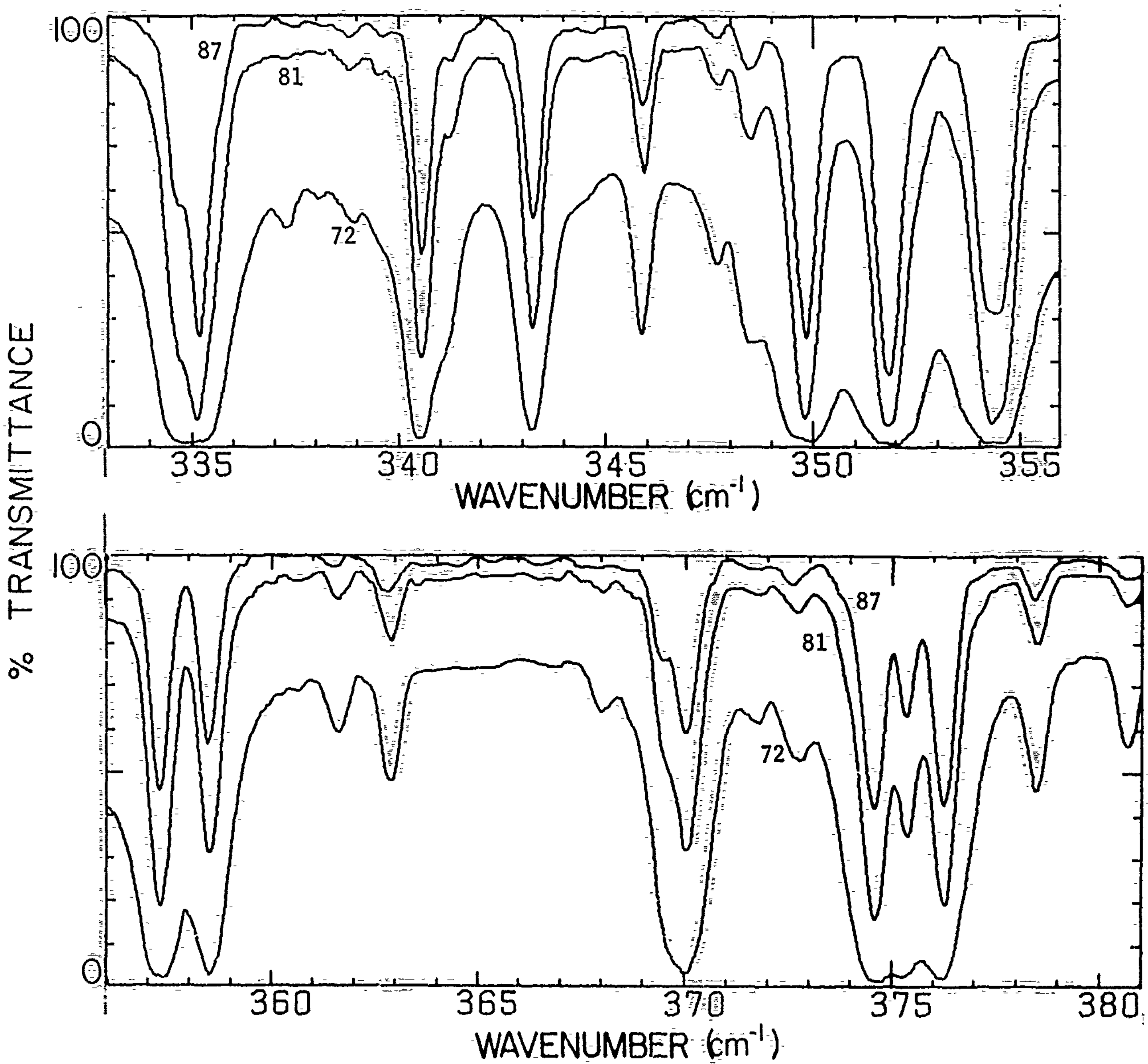
Tables 6 and 7 list values of the cumulative integrated absorptance based on the same samples as those represented by Figures 4 through 9. Each column corresponds to the sample indicated at the top.

TABLE 4. H_2O SAMPLE PARAMETERS

Sample No.	p (atm)	P (atm)	L (cm)	u (#/cm^2)	θ (^oK)	Resl. Schedule	Spectral Region (cm^{-1})	Figure No.
173	0.0115	0.0115	59500	169.+20	296	B	380-444	9
171	0.00882	0.00882	59500	130.+20	296	B	380-444	9
170	0.00553	0.00553	59500	81.6+20	296	B	380-444	9
61	0.0213	0.0213	2884	15.2+20	296	A	380-444	7
56	0.0158	0.0158	420	1.65+20	296	A	380-444	7
136	0.0207	1.004	2884	12.9+20	338	A	380-444	8
133	0.0207	0.500	2884	12.9+20	338	A	380-444	8
115	0.0208	0.0208	2884	12.9+20	338	A	380-444	8
182	0.0141	0.0141	12300	43.0+20	296	C	333-381	6
180	0.00868	0.00868	12300	26.5+20	296	C	333-381	6
72	0.0207	0.0207	2884	14.8+20	296	C	333-381	4
81	0.0211	0.0211	420	2.19+20	296	C	333-381	4
87	0.0105	0.0105	420	1.09+20	296	C	333-381	4
111	0.0326	0.0326	2884	20.7+20	333	C	333-381	5
147	0.0212	1.000	420	1.93+20	338	C	333-381	5
141	0.0213	0.500	420	1.95+20	338	C	333-381	5
104	0.0213	0.0213	420	1.95+20	338	C	333-381	5

TABLE 5. SPECTRAL RESOLUTION SCHEDULE

ν (cm^{-1})	A (cm^{-1})	B (cm^{-1})	C (cm^{-1})
380	0.23	0.32	0.42
390	0.25	0.34	0.46
400	0.28	0.36	0.48
410	0.30	0.39	0.52
420	0.32	0.42	0.56
430	0.35	0.45	0.60
440	0.37	0.48	0.64
450	0.39	0.51	0.68



Sample No.	p = P (atm)	u (molecules/cm^2)
87	0.0105	1.09×10^{20}
81	0.0211	2.19×10^{20}
72	0.0207	14.8×10^{20}

Figure 4. Spectral curves of transmittance of H_2O from 333 to 381 cm^{-1}. θ = 296 K for all samples.

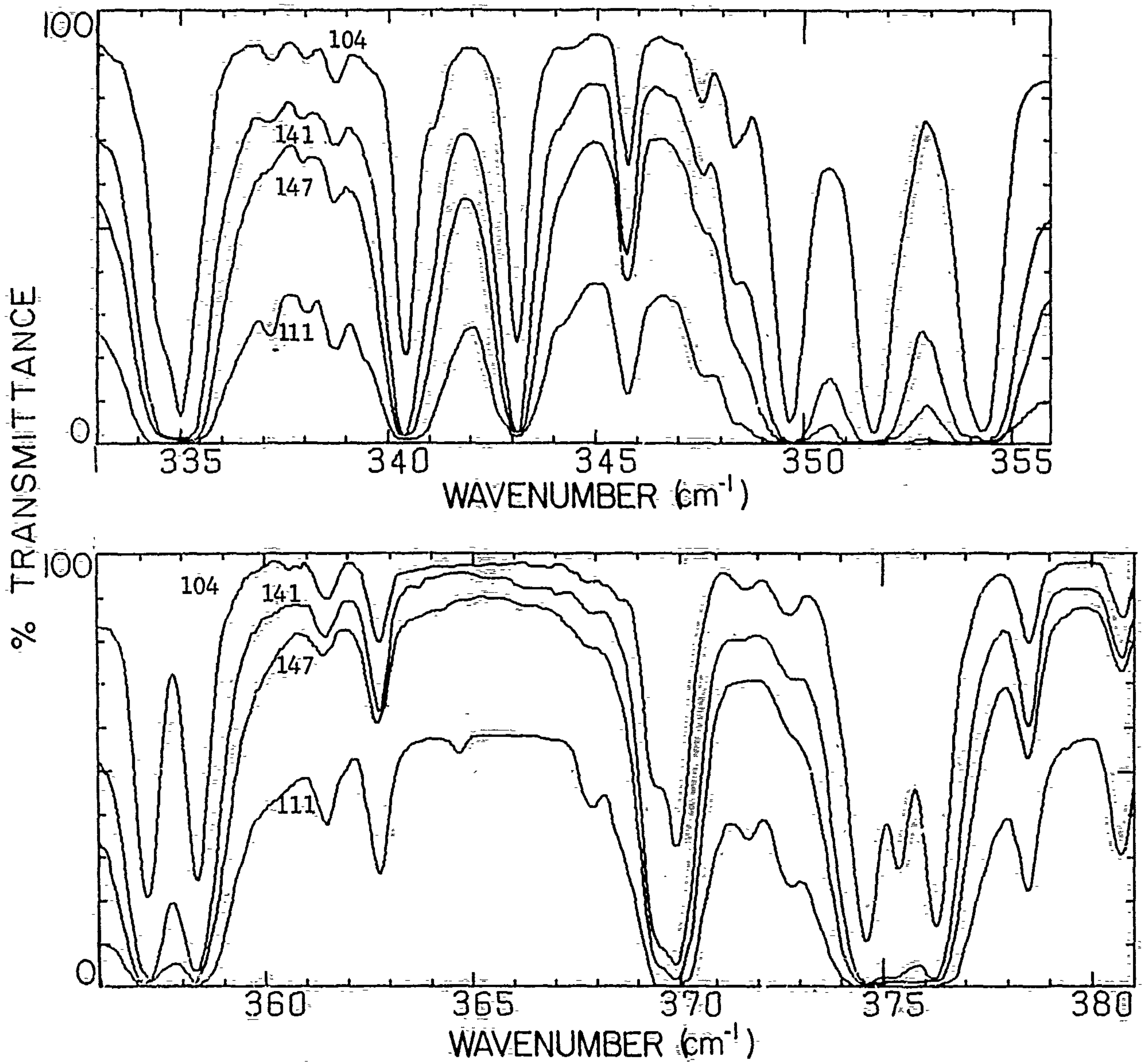


Figure 5. Spectral curves of transmittance of H_2O from 333 to 381 cm^{-1}.

Sample No.	p (atm)	P (atm)	u (molecules/cm^2)	θ (^{o}K)
104	0.0213	0.0213	1.95×10^{20}	338
141	0.0213	0.500	1.95×10^{20}	338
147	0.0212	1.00	1.93×10^{20}	338
111	0.0326	0.0326	20.7×10^{20}	333

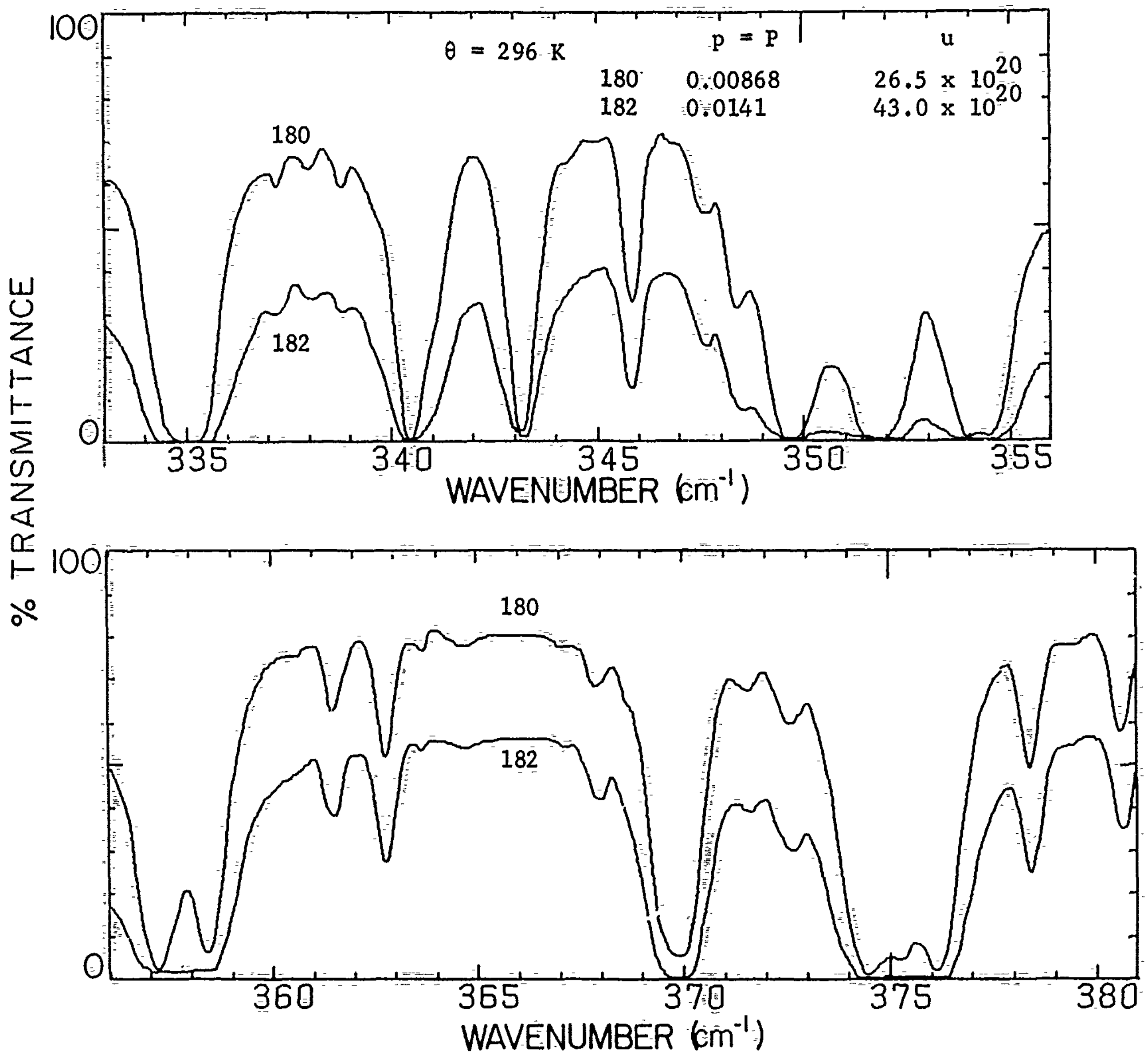


Figure 6. Spectral curves of transmittance of H_2O from 333 to 381 cm^{-1}. Pressures are atm; absorber thicknesses u are in molecules/cm^2.

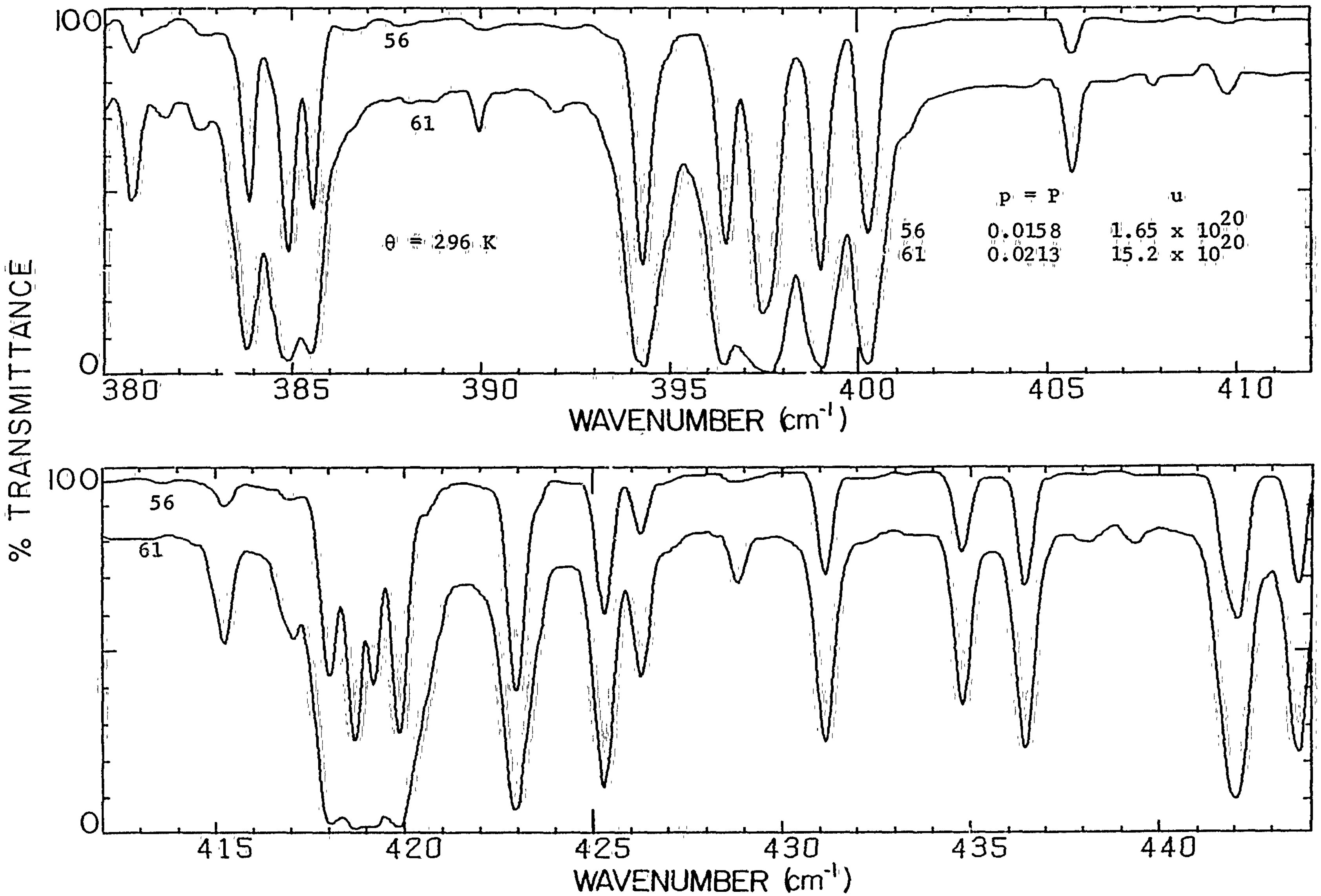


Figure 7. Spectral curves of transmittance of H_2O from 380 to 444 cm^{-1}. Pressures are in atm; absorber thicknesses u are in molecules/cm^2.

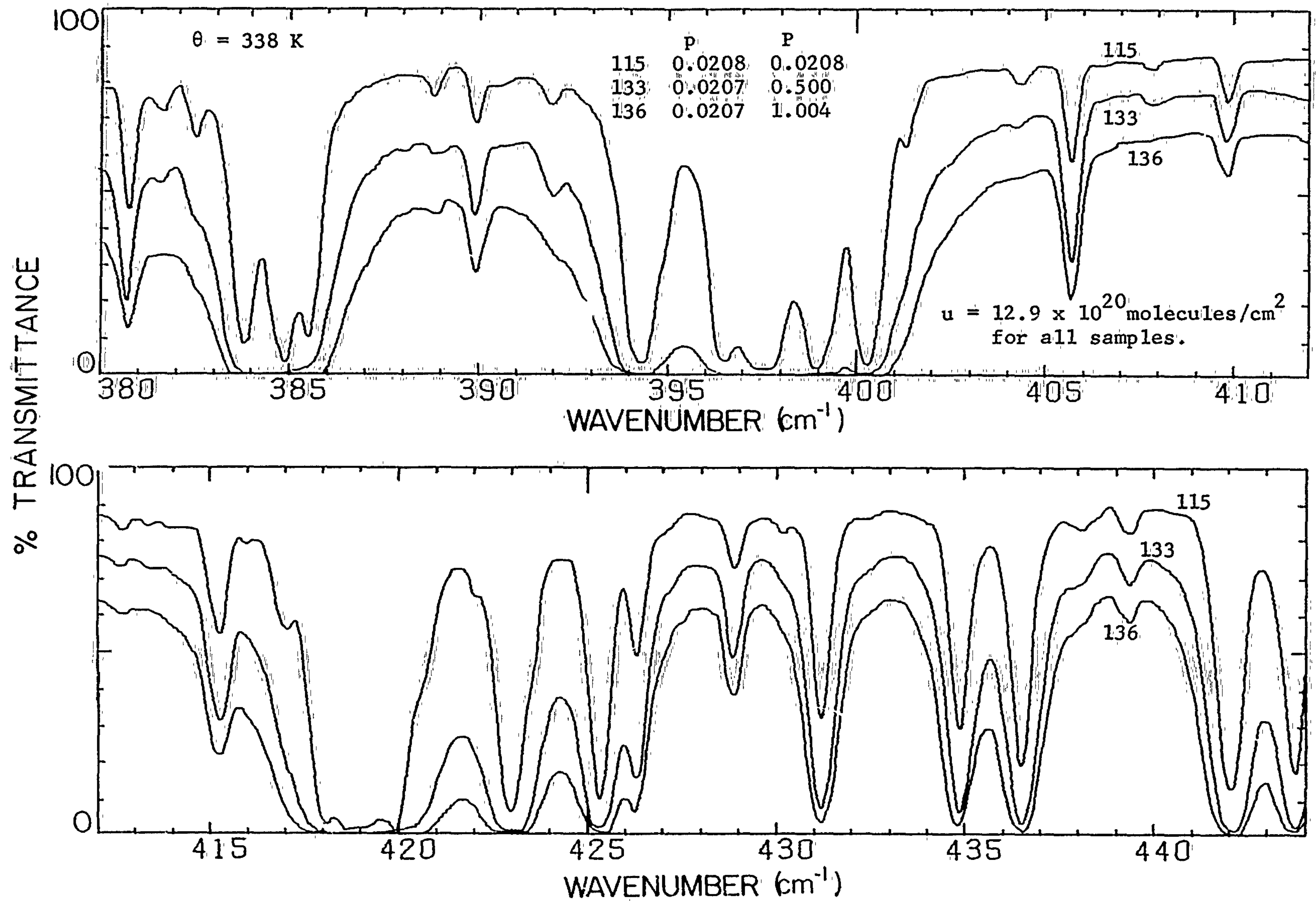


Figure 8. Spectral curves of transmittance of H_2O from 380 to 444 cm^{-1}. Pressures are in atm.

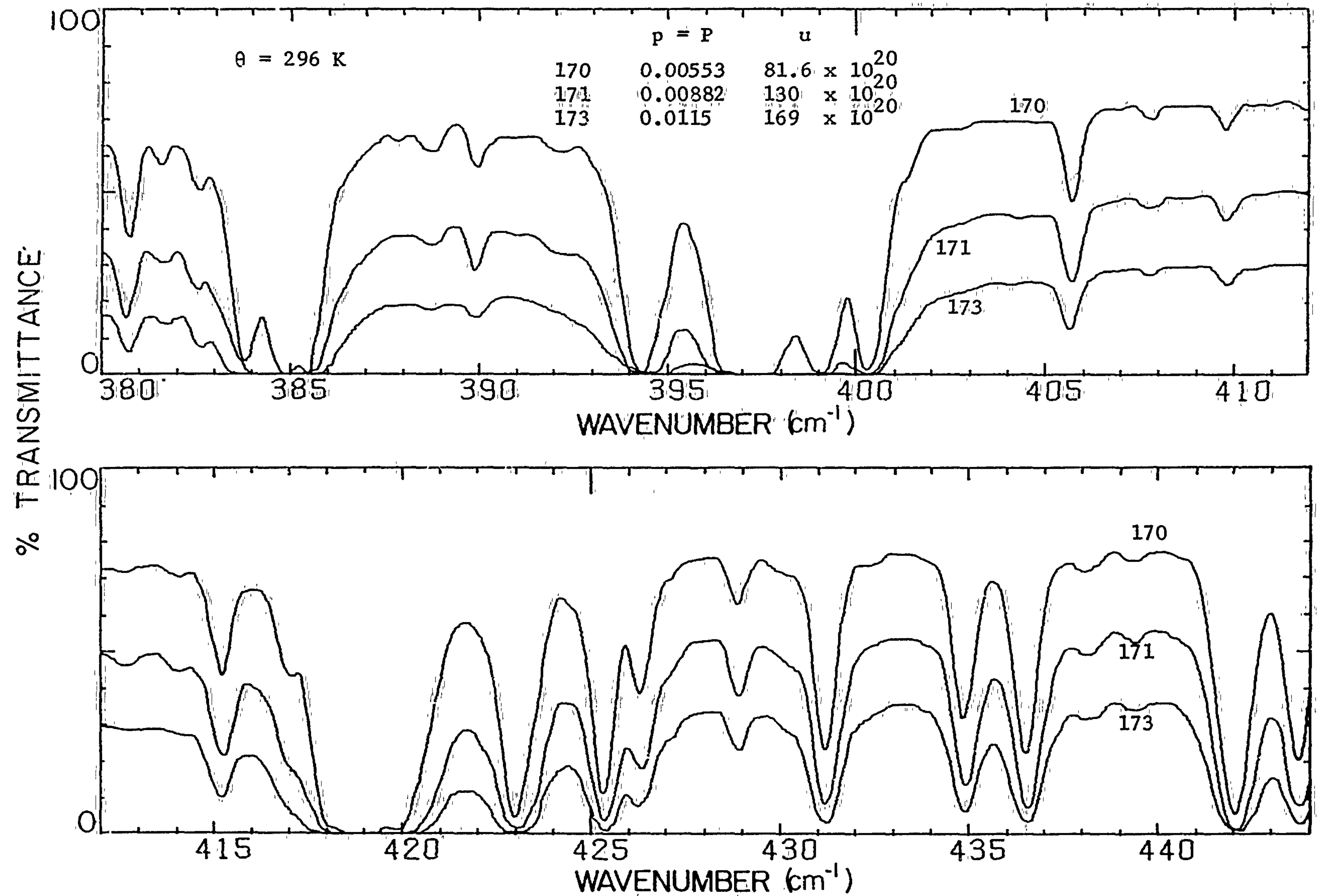


Figure 9. Spectral curves of transmittance from 380 to 444 cm^{-1}. Pressures are in atm; absorber thicknesses are in molecules/cm^2.

TABLE 6 $\int_{\nu'}^{\nu} A\,d\nu$

Sam. No.	182.	180.	72.	81.	87.	111.	147.	141.	104.
Temp (K)	296.	296.	296.	296.	296.	333.	338.	338.	338.
Path (cm)	12300.	12300.	2884.	420.	420.	2884.	420.	420.	420.
p (atm)	0.01408	0.00868	0.02066	0.02105	0.01053	0.03263	0.02118	0.02132	0.02132
P (atm)	0.01408	0.00868	0.02066	0.02105	0.01053	0.03263	1.00000	0.50000	0.02132
u (#/cm^2)*	4.296E 21	2.650E 21	1.478E 21	2.194E 20	1.097E 20	2.075E 21	1.933E 20	1.945E 20	1.945E 20
ν (cm)$^{-1}$									
333.00	0.	0.	0.	0.	0.	0.	0.	0.	0.
333.20	0.147	0.078	0.095	0.019	0.	0.149	0.085	0.050	0.016
333.40	0.297	0.157	0.193	0.040	0.000	0.300	0.177	0.120	0.034
333.60	0.454	0.241	0.299	0.064	0.001	0.459	0.280	0.187	0.055
333.80	0.619	0.335	0.410	0.093	0.005	0.626	0.396	0.269	0.080
334.00	0.790	0.450	0.555	0.130	0.012	0.806	0.533	0.374	0.116
334.20	0.987	0.593	0.713	0.181	0.025	0.996	0.695	0.508	0.166
334.40	1.195	0.762	0.894	0.265	0.053	1.193	0.875	0.672	0.240
334.60	1.385	0.950	1.099	0.396	0.118	1.393	1.067	0.857	0.361
334.80	1.595	1.144	1.297	0.552	0.205	1.593	1.264	1.053	0.513
335.00	1.785	1.347	1.485	0.722	0.304	1.793	1.462	1.250	0.678
335.20	1.985	1.547	1.683	0.907	0.443	1.993	1.661	1.448	0.861
335.40	2.185	1.747	1.880	1.077	0.571	2.193	1.860	1.646	1.033
335.60	2.395	1.944	2.072	1.214	0.648	2.393	2.058	1.840	1.178
335.80	2.596	2.123	2.253	1.316	0.695	2.591	2.251	2.015	1.272
336.00	2.776	2.265	2.411	1.380	0.719	2.783	2.427	2.155	1.336
336.20	2.957	2.379	2.546	1.415	0.726	2.965	2.578	2.260	1.371
336.40	3.125	2.476	2.665	1.441	0.730	3.137	2.706	2.344	1.396
336.60	3.286	2.562	2.770	1.464	0.734	3.299	2.814	2.414	1.416
336.80	3.433	2.641	2.865	1.485	0.738	3.453	2.908	2.473	1.434
337.00	3.576	2.717	2.956	1.504	0.740	3.600	2.990	2.523	1.450
337.20	3.714	2.793	3.050	1.523	0.742	3.745	3.067	2.574	1.468
337.40	3.854	2.873	3.140	1.543	0.746	3.895	3.141	2.625	1.491
337.60	3.990	2.943	3.239	1.562	0.751	4.037	3.210	2.673	1.511
337.80	4.117	3.011	3.322	1.579	0.754	4.169	3.274	2.716	1.527
338.00	4.247	3.091	3.404	1.596	0.757	4.301	3.330	2.763	1.543
338.20	4.381	3.153	3.490	1.613	0.762	4.439	3.407	2.812	1.564
338.40	4.513	3.218	3.570	1.629	0.766	4.577	3.476	2.860	1.585
338.60	4.644	3.285	3.656	1.648	0.772	4.714	3.545	2.910	1.604
338.80	4.779	3.359	3.747	1.671	0.780	4.865	3.626	2.960	1.632
339.00	4.914	3.439	3.842	1.695	0.789	5.021	3.714	3.030	1.664
339.20	5.056	3.512	3.935	1.716	0.794	5.170	3.798	3.087	1.690
339.40	5.197	3.589	4.032	1.737	0.798	5.310	3.883	3.143	1.711
339.60	5.347	3.674	4.136	1.764	0.806	5.476	3.977	3.207	1.734
339.80	5.509	3.769	4.249	1.798	0.815	5.641	4.099	3.283	1.761
340.00	5.681	3.876	4.375	1.828	0.823	5.816	4.225	3.393	1.792
340.20	5.867	4.010	4.528	1.873	0.836	6.004	4.391	3.523	1.841
340.40	6.064	4.196	4.713	1.972	0.865	6.200	4.579	3.659	1.939
340.60	6.263	4.395	4.908	2.124	0.904	6.399	4.775	3.894	2.090
340.80	6.461	4.586	5.098	2.266	1.074	6.597	4.971	4.082	2.233
341.00	6.656	4.755	5.269	2.354	1.114	6.794	5.157	4.247	2.323
341.20	6.843	4.904	5.420	2.413	1.135	6.980	5.325	4.385	2.383
341.40	7.019	5.032	5.571	2.467	1.155	7.172	5.470	4.501	2.435
341.60	7.180	5.133	5.680	2.505	1.168	7.344	5.599	4.596	2.472
341.80	7.327	5.213	5.796	2.531	1.175	7.504	5.690	4.652	2.496
342.00	7.466	5.283	5.877	2.551	1.180	7.656	5.779	4.718	2.515
342.20	7.603	5.351	5.965	2.571	1.182	7.803	5.866	4.769	2.533
342.40	7.741	5.423	6.056	2.591	1.184	7.953	5.962	4.834	2.552
342.60	7.896	5.508	6.156	2.614	1.189	8.115	6.076	4.917	2.576
342.80	8.066	5.620	6.240	2.647	1.197	8.294	6.221	5.032	2.610
343.00	8.251	5.769	6.439	2.709	1.223	8.454	6.356	5.186	2.680
343.20	8.447	5.956	6.625	2.823	1.291	8.650	6.597	5.371	2.807
343.40	8.645	6.147	6.814	2.966	1.379	8.876	6.782	5.563	2.954
343.60	8.833	6.300	6.993	3.060	1.438	9.069	6.960	5.728	3.055
343.80	9.001	6.432	7.121	3.107	1.446	9.254	7.131	5.852	3.107

Sam. No.	182.	180.	72.	81.	87.	111.	147.	141.	104.
Temp (K)	296.	296.	296.	296.	296.	333.	338.	338.	338.
Path (cm)	12300.	12300.	2884.	420.	420.	2884.	420.	420.	420.
p (atm)	0.01408	0.00868	0.02066	0.02105	0.01053	0.03263	0.02118	0.02132	0.02132
P (atm)	0.01408	0.00868	0.02066	0.02105	0.01053	0.03263	1.00000	0.50000	0.02132
u (#/cm^2)*	4.296E 21	2.650E 21	1.478E 21	2.194E 20	1.097E 20	2.075E 21	1.933E 20	1.945E 20	1.945E 20
ν (cm)$^{-1}$									
357.00	20.470	15.428	16.824	7.769	3.920	21.132	17.057	14.444	8.146
357.20	20.675	15.618	17.017	7.[illegible]	4.087	21.332	17.294	14.633	8.277
357.40	20.871	15.813	17.213	8.[illegible]2	4.113	21.532	17.493	14.829	8.435
357.60	21.060	15.997	17.407	8.217	4.184	21.732	17.680	15.019	8.567
357.80	21.265	16.169	17.589	8.301	4.215	21.932	17.881	15.191	8.658
358.00	21.461	16.329	17.756	8.356	4.231	22.132	18.072	15.354	8.700
358.20	21.659	16.494	17.928	8.420	4.259	22.332	18.262	15.524	8.782
358.40	21.856	16.675	18.114	8.527	4.324	22.532	18.457	15.710	8.900
358.60	22.050	16.862	18.307	8.663	4.407	22.731	18.654	15.902	9.048
358.80	22.243	17.035	18.492	8.775	4.461	22.928	18.843	16.081	9.171
359.00	22.425	17.172	18.649	8.830	4.483	23.120	19.015	16.234	9.247
359.20	22.591	17.278	18.773	8.873	4.492	23.300	19.164	16.340	9.288
359.40	22.739	17.365	18.873	8.897	4.498	23.464	19.216	16.429	9.315
359.60	22.870	17.438	18.956	8.917	4.499	23.612	19.335	16.488	9.335
359.80	22.993	17.502	19.034	8.932	4.500	23.749	19.465	16.533	9.348
360.00	23.109	17.550	19.105	8.945	4.500	23.874	19.534	16.570	9.357
360.20	23.221	17.610	19.171	8.950	4.500	23.993	19.593	16.601	9.364
360.40	23.329	17.660	19.236	8.960	4.501	24.109	19.645	16.630	9.369
360.60	23.436	17.718	19.299	8.979	4.502	24.221	19.691	16.657	9.373
360.80	23.539	17.759	19.361	8.991	4.503	24.331	19.733	16.681	9.380
361.00	23.640	17.806	19.420	9.002	4.503	24.436	19.771	16.705	9.386
361.20	23.738	17.850	19.480	9.010	4.504	24.540	19.809	16.730	9.392
361.40	23.849	17.904	19.547	9.021	4.507	24.649	19.850	16.758	9.402
361.60	23.972	17.977	19.625	9.039	4.513	24.769	19.896	16.794	9.428
361.80	24.090	18.044	19.705	9.054	4.516	24.892	19.941	16.831	9.440
362.00	24.189	18.096	19.774	9.071	4.516	25.008	19.979	16.859	9.454
362.20	24.285	18.140	19.831	9.079	4.518	25.100	20.015	16.882	9.458
362.40	24.382	18.184	19.890	9.090	4.522	25.196	20.054	16.906	9.466
362.60	24.493	18.241	19.957	9.106	4.531	25.302	20.103	16.939	9.477
362.80	24.620	18.325	20.047	9.135	4.546	25.430	20.171	16.994	9.506
363.00	24.769	18.417	20.150	9.173	4.562	25.576	20.245	17.064	9.543
363.20	24.877	18.482	20.237	9.201	4.573	25.704	20.311	17.117	9.572
363.40	24.984	18.529	20.300	9.216	4.578	25.806	20.354	17.144	9.585
363.60	25.075	18.572	20.356	9.230	4.582	25.899	20.388	17.162	9.595
363.80	25.167	18.619	20.410	9.243	4.587	25.986	20.419	17.178	9.604
364.00	25.256	18.658	20.463	9.255	4.592	26.073	20.445	17.193	9.612
364.20	25.345	18.696	20.516	9.267	4.596	26.159	20.476	17.205	9.619
364.40	25.435	18.736	20.569	9.278	4.601	26.245	20.504	17.216	9.625
364.60	25.526	18.779	20.622	9.290	4.606	26.332	20.529	17.226	9.631
364.80	25.610	18.823	20.675	9.300	4.610	26.422	20.553	17.235	9.638
365.00	25.710	18.867	20.728	9.310	4.612	26.513	20.575	17.244	9.644
365.20	25.800	18.909	20.780	9.320	4.616	26.600	20.597	17.254	9.650
365.40	25.889	18.949	20.832	9.330	4.617	26.684	20.617	17.265	9.656
365.60	25.977	18.989	20.883	9.344	4.619	26.759	20.638	17.277	9.662
365.80	26.065	19.029	20.933	9.350	4.621	26.851	20.659	17.289	9.667
366.00	26.153	19.069	20.982	9.360	4.623	26.938	20.680	17.301	9.673
366.20	26.241	19.108	21.031	9.368	4.625	27.023	20.702	17.314	9.678
366.40	26.329	19.145	21.080	9.378	4.629	27.107	20.725	17.330	9.683
366.60	26.416	19.187	21.131	9.389	4.633	27.192	20.750	17.346	9.688
366.80	26.504	19.227	21.183	9.400	4.636	27.277	20.774	17.362	9.695
367.00	26.593	19.270	21.235	9.411	4.639	27.363	20.800	17.379	9.701
367.20	26.684	19.315	21.286	9.421	4.640	27.450	20.820	17.397	9.707
367.40	26.775	19.360	21.336	9.430	4.644	27.537	20.859	17.415	9.713
367.60	26.869	19.405	21.389	9.441	4.649	27.627	20.892	17.434	9.720
367.80	26.971	19.458	21.448	9.454	4.655	27.729	20.931	17.456	9.730

PRECEDING PAGE BLANK-NOT FILMED

344.00	9.151	6.523	7.231	3.134	1.454	9.426	7.263	5.987	3.137
344.20	9.298	6.593	7.326	3.155	1.461	9.580	7.367	5.990	3.158
344.40	9.423	6.668	7.415	3.175	1.467	9.726	7.456	6.053	3.176
344.60	9.558	6.735	7.501	3.196	1.474	9.867	7.532	6.108	3.194
344.80	9.674	6.797	7.582	3.216	1.481	10.002	7.602	6.141	3.211
345.00	9.796	6.857	7.659	3.235	1.487	10.132	7.666	6.176	3.226
345.20	9.916	6.917	7.733	3.252	1.492	10.258	7.727	6.211	3.237
345.40	10.033	6.977	7.808	3.269	1.497	10.385	7.790	6.246	3.249
345.60	10.160	7.046	7.895	3.298	1.503	10.528	7.861	6.293	3.265
345.80	10.325	7.134	8.017	3.335	1.527	10.678	7.960	6.376	3.306
346.00	10.499	7.286	8.160	3.402	1.566	10.854	8.083	6.486	3.372
346.20	10.657	7.394	8.275	3.454	1.593	11.020	8.191	6.572	3.419
346.40	10.797	7.468	8.362	3.476	1.600	11.165	8.265	6.617	3.440
346.60	10.911	7.528	8.448	3.494	1.603	11.302	8.326	6.654	3.454
346.80	11.033	7.586	8.510	3.511	1.605	11.433	8.386	6.691	3.468
347.00	11.156	7.647	8.598	3.527	1.607	11.566	8.447	6.731	3.482
347.20	11.282	7.710	8.680	3.542	1.608	11.702	8.514	6.773	3.496
347.40	11.410	7.794	8.770	3.558	1.611	11.848	8.597	6.826	3.518
347.60	11.566	7.872	8.874	3.582	1.618	12.007	8.677	6.891	3.550
347.80	11.721	7.966	8.988	3.614	1.628	12.176	8.777	6.966	3.592
348.00	11.874	8.057	9.095	3.641	1.638	12.345	8.882	7.039	3.625
348.20	12.035	8.161	9.213	3.678	1.641	12.517	8.999	7.126	3.659
348.40	12.212	8.290	9.354	3.716	1.660	12.700	9.139	7.234	3.707
348.60	12.397	8.427	9.505	3.772	1.684	12.891	9.293	7.360	3.770
348.80	12.582	8.559	9.656	3.821	1.703	13.083	9.455	7.486	3.828
349.00	12.769	8.695	9.811	3.864	1.715	13.279	9.626	7.621	3.879
349.20	12.961	8.850	9.980	3.919	1.730	13.476	9.810	7.778	3.942
349.40	13.153	9.030	10.166	4.006	1.759	13.676	10.003	7.960	4.042
349.60	13.357	9.225	10.361	4.144	1.833	13.876	10.200	8.154	4.188
349.80	13.556	9.424	10.557	4.323	1.965	14.076	10.400	8.353	4.370
350.00	13.755	9.623	10.755	4.504	2.106	14.276	10.599	8.552	4.557
350.20	13.954	9.816	10.951	4.651	2.195	14.476	10.799	8.750	4.714
350.40	14.151	9.998	11.141	4.749	2.234	14.676	10.996	8.948	4.827
350.60	14.347	10.168	11.322	4.818	2.256	14.876	11.191	9.119	4.910
350.80	14.543	10.334	11.496	4.877	2.275	15.076	11.383	9.291	4.984
351.00	14.739	10.501	11.674	4.936	2.294	15.276	11.577	9.464	5.060
351.20	14.937	10.676	11.859	5.007	2.316	15.476	11.776	9.648	5.146
351.40	15.135	10.864	12.051	5.111	2.357	15.676	11.976	9.840	5.262
351.60	15.334	11.061	12.247	5.263	2.449	15.876	12.176	10.030	5.421
351.80	15.533	11.259	12.445	5.446	2.599	16.076	12.376	10.230	5.610
352.00	15.733	11.459	12.644	5.636	2.760	16.276	12.575	10.437	5.803
352.20	15.933	11.657	12.842	5.801	2.876	16.476	12.773	10.635	5.978
352.40	16.132	11.850	13.037	5.922	2.959	16.676	12.971	10.828	6.115
352.60	16.330	12.031	13.225	6.011	2.977	16.876	13.167	11.010	6.223
352.80	16.524	12.193	13.398	6.079	3.006	17.075	13.359	11.177	6.306
353.00	16.714	12.337	13.558	6.130	3.025	17.273	13.546	11.327	6.360
353.20	16.906	12.480	13.714	6.176	3.040	17.471	13.729	11.478	6.420
353.40	17.100	12.633	13.877	6.228	3.060	17.671	13.915	11.638	6.488
353.60	17.297	12.801	14.054	6.293	3.083	17.871	14.106	11.811	6.555
353.80	17.496	12.984	14.241	6.387	3.126	18.071	14.302	11.997	6.650
354.00	17.695	13.179	14.435	6.522	3.289	18.271	14.501	12.192	6.801
354.20	17.895	13.377	14.632	6.595	3.336	18.471	14.701	12.389	6.979
354.40	18.095	13.574	14.830	6.803	3.475	18.671	14.901	12.587	7.171
354.60	18.295	13.772	15.028	7.060	3.611	18.871	15.101	12.786	7.364
354.80	18.495	13.967	15.225	7.235	3.727	19.070	15.300	12.983	7.541
355.00	18.692	14.148	15.411	7.354	3.787	19.267	15.498	13.175	7.674
355.20	18.886	14.305	15.581	7.423	3.800	19.461	15.685	13.350	7.750
355.40	19.070	14.430	15.732	7.467	3.821	19.651	15.866	13.498	7.808
355.60	19.244	14.556	15.866	7.503	3.833	19.830	16.029	13.622	7.846
355.80	19.411	14.666	15.990	7.535	3.844	20.020	16.170	13.730	7.881
356.00	19.576	14.770	16.109	7.566	3.858	20.201	16.316	13.830	7.915
356.20	19.743	14.873	16.228	7.596	3.868	20.382	16.451	13.927	7.948
356.40	19.915	14.986	16.353	7.627	3.880	20.563	16.588	14.028	7.982
356.60	20.095	15.105	16.489	7.663	3.879	20.747	16.741	14.148	8.020
356.80	20.284	15.252	16.644	7.709	3.896	20.936	16.911	14.277	8.066

368.00	27.005	19.521	21.518	9.469	4.661	27.843	20.974	17.483	9.744
368.20	27.199	19.582	21.590	9.485	4.666	27.960	21.018	17.510	9.757
368.40	27.387	19.637	21.657	9.498	4.672	28.072	21.064	17.538	9.772
368.60	27.421	19.690	21.726	9.513	4.679	28.196	21.119	17.570	9.789
368.80	27.547	19.769	21.805	9.531	4.686	28.338	21.186	17.613	9.810
369.00	27.687	19.850	21.894	9.551	4.694	28.479	21.272	17.672	9.833
369.20	27.840	19.957	22.005	9.584	4.711	28.643	21.392	17.763	9.872
369.40	28.030	20.104	22.150	9.650	4.750	28.826	21.551	17.905	9.940
369.60	28.225	20.281	22.325	9.744	4.798	29.024	21.737	18.080	10.053
369.80	28.425	20.466	22.512	9.850	4.852	29.224	21.928	18.263	10.163
370.00	28.624	20.655	22.705	9.975	4.927	29.424	22.124	18.450	10.287
370.20	28.823	20.843	22.897	10.109	5.005	29.624	22.319	18.630	10.420
370.40	29.018	21.011	23.079	10.213	5.057	29.821	22.503	18.806	10.524
370.60	29.196	21.146	23.230	10.278	5.080	30.008	22.664	18.941	10.587
370.80	29.354	21.248	23.364	10.316	5.092	30.176	22.788	19.036	10.625
371.00	29.489	21.324	23.461	10.338	5.096	30.320	22.876	19.097	10.641
371.20	29.611	21.387	23.539	10.354	5.098	30.453	22.946	19.142	10.651
371.40	29.730	21.448	23.611	10.369	5.102	30.579	23.018	19.183	10.661
371.60	29.850	21.512	23.685	10.385	5.108	30.706	23.078	19.223	10.675
371.80	29.971	21.576	23.762	10.403	5.114	30.837	23.130	19.263	10.691
372.00	30.089	21.635	23.835	10.421	5.120	30.966	23.189	19.301	10.707
372.20	30.207	21.694	23.904	10.435	5.125	31.090	23.248	19.340	10.720
372.40	30.334	21.761	23.980	10.452	5.132	31.219	23.312	19.382	10.736
372.60	30.469	21.839	24.068	10.473	5.145	31.360	23.385	19.433	10.759
372.80	30.609	21.919	24.163	10.499	5.157	31.513	23.466	19.489	10.787
373.00	30.745	21.996	24.255	10.522	5.165	31.666	23.552	19.547	10.814
373.20	30.879	22.069	24.342	10.541	5.171	31.819	23.643	19.607	10.835
373.40	31.022	22.152	24.434	10.561	5.176	31.981	23.747	19.674	10.856
373.60	31.180	22.253	24.540	10.587	5.185	32.155	23.871	19.757	10.884
373.80	31.353	22.376	24.666	10.627	5.201	32.339	24.017	19.869	10.938
374.00	31.539	22.526	24.817	10.687	5.225	32.531	24.185	20.014	10.999
374.20	31.732	22.701	24.991	10.772	5.266	32.729	24.372	20.186	11.098
374.40	31.931	22.890	25.181	10.898	5.343	32.929	24.568	20.375	11.240
374.60	32.131	23.088	25.378	11.050	5.454	33.129	24.766	20.573	11.413
374.80	32.331	23.284	25.575	11.220	5.559	33.329	24.965	20.771	11.585
375.00	32.530	23.476	25.771	11.343	5.621	33.529	25.163	20.967	11.727
375.20	32.729	23.666	25.966	11.453	5.672	33.729	25.362	21.163	11.855
375.40	32.928	23.857	26.161	11.579	5.742	33.929	25.560	21.359	11.995
375.60	33.127	24.045	26.354	11.700	5.805	34.129	25.750	21.553	12.134
375.80	33.326	24.229	26.543	11.797	5.847	34.329	25.956	21.745	12.249
376.00	33.525	24.415	26.733	11.908	5.903	34.529	26.155	21.936	12.369
376.20	33.724	24.610	26.929	12.049	6.001	34.729	26.353	22.131	12.525
376.40	33.924	24.804	27.124	12.209	6.113	34.928	26.550	22.326	12.695
376.60	34.122	24.982	27.300	12.330	6.188	35.126	26.743	22.511	12.837
376.80	34.318	25.128	27.469	12.401	6.217	35.322	26.921	22.668	12.927
377.00	34.481	25.246	27.607	12.441	6.230	35.510	27.076	22.791	12.980
377.20	34.636	25.339	27.710	12.468	6.241	35.683	27.204	22.881	13.015
377.40	34.772	25.414	27.808	12.489	6.250	35.839	27.306	22.943	13.038
377.60	34.897	25.478	27.884	12.505	6.256	35.982	27.389	22.994	13.053
377.80	35.013	25.536	27.952	12.519	6.261	36.113	27.459	23.035	13.065
378.00	35.125	25.591	28.018	12.531	6.267	36.237	27.522	23.072	13.075
378.20	35.242	25.696	28.092	12.549	6.274	36.365	27.599	23.115	13.090
378.40	35.378	25.744	28.187	12.581	6.289	36.510	27.676	23.181	13.120
378.60	35.526	25.843	28.295	12.621	6.309	36.664	27.767	23.259	13.164
378.80	35.659	25.921	28.397	12.652	6.322	36.799	27.844	23.318	13.190
379.00	35.763	25.974	28.451	12.668	6.327	36.909	27.894	23.349	13.202
379.20	35.857	26.019	28.505	12.678	6.331	37.004	27.930	23.370	13.210
379.40	35.949	26.064	28.555	12.687	6.333	37.098	27.961	23.387	13.216
379.60	36.039	26.100	28.603	12.696	6.335	37.187	27.988	23.404	13.221
379.80	36.127	26.151	28.650	12.705	6.337	37.274	28.014	23.420	13.226
380.00	36.215	26.191	28.698	12.714	6.340	37.362	28.040	23.437	13.230
380.20	36.303	26.232	28.745	12.724	6.343	37.448	28.067	23.455	13.235
380.40	36.399	26.283	28.801	12.735	6.348	37.547	28.099	23.479	13.243
380.60	36.516	26.357	28.870	12.753	6.357	37.670	28.144	23.516	13.262
380.80	36.646	26.439	28.965	12.776	6.368	37.803	28.190	23.563	13.290
381.00	36.763	26.505	29.041	12.795	6.378	37.932	28.245	23.601	13.313

* The units of u are molecules/cm^2, abbreviated here by (#/cm^2).

TABLE 7 $\int_{\nu'}^{\nu} A\,d\nu$

Sam. No.	173.	171.	170.	61.	56.	136.	133.	115.
Temp. (K)	296.	296.	296.	296.	296.	338.	338.	338.
Path (cm)	59500.	59500.	59500.	2884.	420.	2884.	2884.	2884.
p (atm)	0.01145	0.00882	0.00553	0.02132	0.01579	0.02066	0.02066	0.02079
P (atm)	0.01145	0.00882	0.00553	0.02132	0.01579	1.00395	0.50000	0.02079
u (#/cm^2)*	1.690E 22	1.301E 22	8.158E 21	1.525E 21	1.645E 20	1.294E 21	1.294E 21	1.303E 21
ν (cm)$^{-1}$								
380.00	0.	0.	0.	0.	0.	0.	0.	0.
380.20	0.168	0.134	0.075	0.052	0.007	0.138	0.090	0.043
380.40	0.338	0.278	0.156	0.103	0.013	0.269	0.192	0.088
380.60	0.519	0.435	0.261	0.177	0.026	0.424	0.326	0.159
380.80	0.706	0.602	0.384	0.279	0.048	0.597	0.481	0.265
381.00	0.880	0.756	0.494	0.369	0.066	0.760	0.605	0.352
381.20	1.059	0.891	0.575	0.420	0.080	0.904	0.706	0.403
381.40	1.228	1.025	0.652	0.481	0.091	1.040	0.759	0.455
381.60	1.398	1.163	0.736	0.539	0.101	1.175	0.834	0.509
381.80	1.571	1.302	0.818	0.597	0.108	1.309	0.907	0.563
382.00	1.741	1.437	0.894	0.649	0.114	1.445	1.075	0.609
382.20	1.910	1.572	0.971	0.700	0.119	1.582	1.166	0.653
382.40	2.084	1.717	1.057	0.760	0.128	1.727	1.272	0.710
382.60	2.266	1.869	1.154	0.825	0.141	1.878	1.357	0.778
382.80	2.450	2.020	1.251	0.890	0.156	2.038	1.508	0.838
383.00	2.633	2.174	1.345	0.952	0.170	2.207	1.641	0.895
383.20	2.822	2.336	1.449	1.024	0.183	2.390	1.791	0.963
383.40	3.018	2.508	1.577	1.130	0.202	2.584	1.966	1.059
383.60	3.217	2.691	1.739	1.272	0.236	2.784	2.158	1.203
383.80	3.417	2.884	1.927	1.451	0.318	2.984	2.356	1.380
384.00	3.617	3.082	2.117	1.630	0.411	3.184	2.556	1.559
384.20	3.817	3.282	2.293	1.782	0.451	3.384	2.756	1.712
384.40	4.017	3.482	2.465	1.922	0.481	3.584	2.956	1.851
384.60	4.217	3.682	2.649	2.089	0.527	3.784	3.156	2.015
384.80	4.417	3.882	2.846	2.277	0.618	3.984	3.356	2.200
385.00	4.617	4.082	3.045	2.469	0.744	4.184	3.556	2.392
385.20	4.817	4.282	3.243	2.654	0.828	4.384	3.754	2.567
385.40	5.017	4.482	3.439	2.837	0.878	4.584	3.951	2.736
385.60	5.217	4.682	3.637	3.024	0.981	4.794	4.147	2.913
385.80	5.417	4.879	3.816	3.192	1.054	4.984	4.339	3.071
386.00	5.615	5.067	3.966	3.308	1.077	5.183	4.517	3.178
386.20	5.808	5.239	4.082	3.394	1.087	5.374	4.674	3.249
386.40	5.994	5.398	4.181	3.469	1.093	5.553	4.811	3.307
386.60	6.174	5.549	4.272	3.537	1.110	5.718	4.938	3.358
386.80	6.348	5.692	4.357	3.599	1.122	5.872	5.034	3.405
387.00	6.519	5.830	4.438	3.655	1.132	6.017	5.129	3.449
387.20	6.686	5.964	4.514	3.707	1.140	6.154	5.219	3.491
387.40	6.852	6.095	4.588	3.758	1.146	6.283	5.305	3.531
387.60	7.015	6.222	4.657	3.808	1.152	6.405	5.387	3.569
387.80	7.177	6.346	4.728	3.858	1.161	6.522	5.465	3.606
388.00	7.339	6.471	4.808	3.907	1.171	6.635	5.543	3.642
388.20	7.501	6.595	4.878	3.959	1.180	6.746	5.620	3.678
388.40	7.663	6.720	4.941	4.010	1.189	6.856	5.695	3.715
388.60	7.827	6.847	5.017	4.061	1.196	6.966	5.769	3.754
388.80	7.992	6.976	5.096	4.112	1.203	7.077	5.847	3.798
389.00	8.156	7.104	5.172	4.161	1.210	7.189	5.926	3.843
389.20	8.318	7.228	5.241	4.208	1.216	7.296	6.005	3.879
389.40	8.480	7.348	5.305	4.253	1.222	7.402	6.081	3.911
389.60	8.643	7.468	5.370	4.299	1.228	7.511	6.158	3.945
389.80	8.809	7.600	5.446	4.348	1.236	7.636	6.250	3.989
390.00	8.977	7.742	5.531	4.412	1.248	7.778	6.361	4.058
390.20	9.143	7.875	5.612	4.467	1.260	7.908	6.455	4.108
390.40	9.305	7.999	5.686	4.514	1.271	8.024	6.533	4.142
390.60	9.463	8.121	5.756	4.560	1.282	8.134	6.609	4.184
390.80	9.620	8.243	5.827	4.605	1.291	8.243	6.685	4.225
391.00	9.778	8.366	5.897	4.650	1.300	8.354	6.759	4.264
391.20	9.938	8.498	5.967	4.695	1.308	8.466	6.833	4.302
391.40	10.098	8.614	6.037	4.741	1.317	8.581	6.907	4.339
391.60	10.259	8.739	6.107	4.789	1.326	8.701	6.987	4.379
391.80	10.422	8.867	6.180	4.840	1.335	8.827	7.079	4.425
392.00	10.588	8.999	6.257	4.896	1.344	8.958	7.180	4.477
392.20	10.754	9.133	6.336	4.952	1.354	9.095	7.281	4.526
392.40	10.923	9.267	6.413	5.005	1.366	9.235	7.377	4.570
392.60	11.093	9.402	6.489	5.056	1.377	9.381	7.479	4.616
392.80	11.266	9.538	6.566	5.109	1.387	9.536	7.588	4.665
393.00	11.443	9.678	6.648	5.165	1.396	9.700	7.710	4.718
393.20	11.623	9.825	6.737	5.228	1.408	9.873	7.847	4.778
393.40	11.809	9.983	6.836	5.303	1.422	10.057	8.003	4.851
393.60	11.999	10.153	6.951	5.391	1.438	10.250	8.175	4.942
393.80	12.190	10.335	7.095	5.506	1.458	10.447	8.364	5.059
394.00	12.385	10.529	7.266	5.664	1.500	10.645	8.561	5.223
394.20	12.582	10.727	7.458	5.853	1.600	10.844	8.760	5.410
394.40	12.782	10.926	7.656	6.049	1.734	11.044	8.959	5.603
394.60	12.982	11.125	7.849	6.230	1.801	11.244	9.159	5.789
394.80	13.182	11.324	8.027	6.382	1.865	11.444	9.356	5.947
395.00	13.382	11.517	8.186	6.509	1.893	11.644	9.550	6.092
395.20	13.580	11.701	8.323	6.615	1.914	11.844	9.739	6.193
395.40	13.776	11.877	8.444	6.708	1.930	12.044	9.924	6.282
395.60	13.970	12.053	8.563	6.793	1.945	12.244	10.108	6.369
395.80	14.164	12.234	8.692	6.892	1.960	12.444	10.295	6.462

* The units of u are molecules/cm^2, abbreviated here by (#/cm^2).

TABLE 7 (cont'd)

Sam. No.	173.	171.	170.	61.	56.	136.	133.	115.
Temp (K)	296.	296.	296.	296.	296.	338.	338.	338.
Path (cm)	59500.	59500.	59500.	2884.	420.	2884.	2884.	2884.
p (atm)	0.01145	0.00882	0.00553	0.02132	0.01579	0.02066	0.02066	0.02079
P (atm)	0.01145	0.00882	0.00553	0.02132	0.01579	1.00395	0.50000	0.02079
u (#/cm^2)*	1.690E 22	1.301E 22	8.158E 21	1.525E 21	1.645E 20	1.294E 21	1.994E 21	1.303E 21
ν (cm)$^{-1}$								
396.00	14.359	12.422	8.838	7.012	1.981	12.644	10.486	6.573
396.20	14.556	12.618	9.005	7.174	2.025	12.844	10.682	6.723
396.40	14.756	12.816	9.196	7.364	2.119	13.044	10.881	6.908
396.60	14.953	13.015	9.395	7.557	2.243	13.244	11.080	7.101
396.80	15.153	13.215	9.594	7.743	2.323	13.444	11.280	7.289
397.00	15.353	13.415	9.794	7.930	2.376	13.644	11.480	7.474
397.20	15.553	13.615	9.994	8.123	2.463	13.844	11.680	7.666
397.40	15.753	13.815	10.194	8.328	2.609	14.044	11.880	7.862
397.60	15.953	14.015	10.394	8.519	2.775	14.244	12.080	8.059
397.80	16.153	14.215	10.594	8.717	2.928	14.444	12.280	8.255
398.00	16.353	14.415	10.790	8.907	3.029	14.644	12.480	8.447
398.20	16.553	14.615	10.977	9.075	3.073	14.844	12.680	8.621
398.40	16.753	14.815	11.157	9.224	3.102	15.044	12.880	8.782
398.60	16.953	15.015	11.339	9.383	3.134	15.244	13.080	8.948
398.80	17.153	15.215	11.529	9.566	3.202	15.444	13.280	9.131
399.00	17.353	15.415	11.726	9.761	3.331	15.644	13.480	9.327
399.20	17.553	15.615	11.925	9.955	3.450	15.844	13.679	9.520
399.40	17.753	15.814	12.118	10.126	3.506	16.044	13.878	9.708
399.60	17.952	16.009	12.295	10.270	3.534	16.244	14.077	9.854
399.80	18.151	16.203	12.456	10.397	3.555	16.444	14.273	9.987
400.00	18.350	16.399	12.623	10.554	3.596	16.644	14.470	10.142
400.20	18.550	16.597	12.812	10.742	3.698	16.844	14.669	10.327
400.40	18.750	16.796	13.008	10.935	3.817	17.044	14.868	10.521
400.60	18.949	16.995	13.198	11.101	3.899	17.244	15.066	10.701
400.80	19.145	17.187	13.359	11.229	3.931	17.444	15.259	10.844
401.00	19.335	17.361	13.483	11.322	3.946	17.640	15.438	10.941
401.20	19.519	17.524	13.584	11.394	3.958	[illegible]	15.602	11.015
401.40	19.697	17.676	13.676	11.463	3.970	18.011	15.752	11.088
401.60	19.869	17.828	13.762	11.526	3.981	18.179	15.882	11.148
401.80	20.036	17.956	13.837	11.580	3.991	18.332	15.997	11.194
402.00	20.199	18.083	13.904	11.638	4.000	18.474	16.098	11.233
402.20	20.357	18.206	13.970	11.679	4.008	18.605	16.191	11.271
402.40	20.515	18.327	14.036	11.726	4.016	18.731	16.278	11.307
402.60	20.671	18.446	14.101	11.772	4.022	18.858	16.363	11.343
402.80	20.826	18.564	14.167	11.817	4.029	18.963	16.442	11.378
403.00	20.980	18.681	14.231	11.861	4.036	19.073	16.517	11.412
403.20	21.132	18.796	14.293	11.904	4.043	19.175	16.589	11.445
403.40	21.284	18.909	14.355	11.947	4.050	19.279	16.658	11.478
403.60	21.434	19.022	14.416	11.990	4.057	19.376	16.726	11.511
403.80	21.584	19.134	14.478	12.032	4.065	19.471	16.791	11.545
404.00	21.734	19.246	14.539	12.075	4.072	19.564	16.855	11.578
404.20	21.885	19.359	14.600	12.118	4.078	19.657	16.919	11.615
404.40	22.035	19.474	14.662	12.162	4.085	19.748	16.983	11.655
404.60	22.184	19.585	14.724	12.205	4.091	19.838	17.044	11.693
404.80	22.333	19.701	14.786	12.247	4.098	19.927	17.102	11.726
405.00	22.483	19.814	14.848	12.287	4.105	20.015	17.160	11.757
405.20	22.635	19.927	14.910	12.328	4.112	20.105	17.220	11.788
405.40	22.791	20.047	14.980	12.376	4.120	20.209	17.295	11.825
405.60	22.961	20.186	15.060	12.450	4.140	20.347	17.406	11.887
405.80	23.134	20.334	15.172	12.536	4.164	20.500	17.539	11.966
406.00	23.295	20.471	15.258	12.594	4.177	20.626	17.637	12.016
406.20	23.445	20.588	15.324	12.637	4.184	20.719	17.708	12.049
406.40	23.592	20.698	15.382	12.678	4.190	20.808	17.752	12.079
406.60	23.736	20.805	15.438	12.718	4.196	20.879	17.802	12.110
406.80	23.879	20.912	15.493	12.759	4.203	20.955	17.851	12.140
407.00	24.02[illegible]	21.017	15.547	12.799	4.210	21.029	17.898	12.168
407.20	24.165	21.121	15.601	12.838	4.217	21.101	17.946	12.196
407.40	24.307	21.225	15.654	12.875	4.225	21.173	17.992	12.225
407.60	24.450	21.331	15.711	12.912	4.234	21.245	18.040	12.254
407.80	24.596	21.440	15.771	12.953	4.243	21.316	18.091	12.286
408.00	24.740	21.549	15.838	12.995	4.252	21.387	18.143	12.319
408.20	24.882	21.655	15.884	13.033	4.260	21.456	18.194	12.347
408.40	25.023	21.758	15.937	13.071	4.267	21.525	18.242	12.374
408.60	25.164	21.862	15.998	13.108	4.273	21.593	18.289	12.401
408.80	25.306	21.965	16.044	13.145	4.279	21.661	18.337	12.428
409.00	25.447	22.069	16.097	13.182	4.284	21.728	18.384	12.454
409.20	25.587	22.172	16.158	13.214	4.291	21.796	18.430	12.479
409.40	25.728	22.274	16.204	13.247	4.298	21.865	18.476	12.505
409.60	25.872	22.380	16.261	13.288	4.306	21.941	18.527	12.533
409.80	26.021	22.494	16.325	13.335	4.315	22.028	18.594	12.576
410.00	26.171	22.608	16.388	13.380	4.324	22.115	18.663	12.623
410.20	26.316	22.716	16.443	13.418	4.332	22.197	18.715	12.656
410.40	26.459	22.820	16.496	13.454	4.339	22.256	18.760	12.684
410.60	26.601	22.922	16.549	13.491	4.346	22.324	18.803	12.712
410.80	26.743	23.024	16.601	13.529	4.354	22.392	18.847	12.739
411.00	26.883	23.125	16.654	13.567	4.362	22.460	18.891	12.766
411.20	27.023	23.226	16.706	13.605	4.370	22.523	18.936	12.793
411.40	27.162	23.325	16.756	13.642	4.378	22.595	18.982	12.820
411.60	27.302	23.425	16.808	13.679	4.385	22.663	19.028	12.846
411.80	27.441	23.525	16.861	13.717	4.392	22.733	19.076	12.872

* The units of u are molecules/cm^2, abbreviated here by (#/cm^2)

TABLE 7 (cont'd)

Sam. No.	173.	171.	170.	61.	56.	136.	133.	115.
Temp (K)	296.	296.	296.	296.	296.	338.	338.	338.
Path (cm)	59500.	59500.	59500.	2884.	420.	2884.	2884.	2884.
p (atm)	0.01145	0.00882	0.00553	0.02138	0.01579	0.02066	0.02066	0.02079
P (atm)$_2$	0.01145	0.00882	0.00553	0.02138	0.01579	1.00395	0.50000	0.02079
u (#/cm^2)*	1.690E 22	1.301E 22	8.158E 21	1.525E 21	1.645E 20	1.294E 21	1.294E 21	1.303E 21
ν (cm)$^{-1}$								
412.00	27.582	23.626	16.917	13.752	4.400	22.805	19.124	12.898
412.20	27.723	23.720	16.972	13.790	4.407	22.879	19.173	12.925
412.40	27.866	23.833	17.028	13.830	4.415	22.955	19.223	12.954
412.60	28.009	23.940	17.085	13.869	4.423	23.034	19.277	12.986
412.80	28.153	24.049	17.142	13.909	4.429	23.115	19.331	13.020
413.00	28.296	24.156	17.197	13.948	4.436	23.194	19.382	13.050
413.20	28.439	24.259	17.251	13.987	4.442	23.272	19.433	13.080
413.40	28.582	24.362	17.305	14.026	4.449	23.350	19.486	13.111
413.60	28.725	24.464	17.359	14.064	4.457	23.430	19.544	13.142
413.80	28.869	24.570	17.416	14.101	4.466	23.513	19.599	13.174
414.00	29.014	24.680	17.475	14.139	4.473	23.599	19.656	13.207
414.20	29.160	24.791	17.535	14.178	4.480	23.688	19.717	13.241
414.40	29.307	24.901	17.592	14.219	4.487	23.780	19.780	13.274
414.60	29.455	25.013	17.653	14.262	4.495	23.880	19.847	13.308
414.80	29.611	25.131	17.723	14.309	4.505	23.991	19.924	13.340
415.00	29.778	25.267	17.813	14.375	4.517	24.125	20.029	13.410
415.20	29.956	25.419	17.919	14.462	4.535	24.279	20.159	13.492
415.40	30.133	25.575	18.026	14.553	4.556	24.436	20.295	13.580
415.60	30.299	25.715	18.109	14.616	4.571	24.577	20.412	13.630
415.80	30.458	25.839	18.180	14.665	4.581	24.709	20.506	13.670
416.00	30.615	25.958	18.247	14.712	4.591	24.843	20.598	13.720
416.20	30.774	26.078	18.314	14.760	4.602	24.983	20.695	13.760
416.40	30.936	26.203	18.384	14.810	4.613	25.131	20.800	13.802
416.60	31.105	26.335	18.463	14.869	4.626	25.288	20.917	13.852
416.80	31.283	26.482	18.559	14.945	4.640	25.457	21.053	13.923
417.00	31.469	26.643	18.669	15.034	4.658	25.639	21.206	14.009
417.20	31.659	26.809	18.783	15.127	4.675	25.829	21.372	14.096
417.40	31.852	26.980	18.908	15.216	4.692	26.024	21.551	14.183
417.60	32.049	27.162	19.039	15.327	4.714	26.222	21.739	14.297
417.80	32.249	27.351	19.206	15.478	4.767	26.421	21.935	14.458
418.00	32.448	27.548	19.397	15.666	4.867	26.621	22.133	14.636
418.20	32.648	27.748	19.593	15.861	4.974	26.821	22.332	14.829
418.40	32.848	27.948	19.791	16.053	5.055	27.021	22.532	15.022
418.60	33.048	28.148	19.991	16.248	5.178	27.221	22.732	15.218
418.80	33.248	28.348	20.191	16.446	5.316	27.421	22.932	15.415
419.00	33.448	28.548	20.391	16.642	5.424	27.621	23.132	15.611
419.20	33.648	28.748	20.591	16.839	5.532	27.821	23.332	15.808
419.40	33.848	28.948	20.798	17.034	5.636	28.021	23.532	16.003
419.60	34.048	29.148	20.987	17.226	5.707	28.221	23.732	16.196
419.80	34.248	29.348	21.185	17.422	5.828	28.421	23.931	16.389
420.00	34.448	29.548	21.382	17.617	5.961	28.621	24.130	16.586
420.20	34.648	29.747	21.575	17.799	6.058	28.821	24.327	16.768
420.40	34.847	29.946	21.755	17.955	6.088	29.021	24.524	16.918
420.60	35.046	30.141	21.919	18.091	6.115	29.221	24.719	17.046
420.80	35.243	30.330	22.066	18.208	6.138	29.420	24.909	17.161
421.00	35.435	30.507	22.191	18.303	6.156	29.616	25.089	17.256
421.20	35.621	30.673	22.298	18.388	6.166	29.807	25.256	17.328
421.40	35.801	30.826	22.398	18.446	6.176	29.994	25.412	17.389
421.60	35.977	30.972	22.476	18.511	6.186	30.177	25.560	17.445
421.80	36.154	31.115	22.561	18.575	6.195	30.358	25.708	17.501
422.00	36.332	31.261	22.650	18.643	6.205	[illegible].541	25.859	17.567
422.20	36.513	31.413	22.745	18.715	6.217	[illegible].738	26.019	17.688
422.40	36.699	31.572	22.851	18.797	6.230	[illegible]	26.191	17.719
422.60	36.893	31.744	22.981	18.909	[illegible]	[illegible]	26.379	17.833
422.80	37.091	31.932	23.144	19.066	[illegible]	[illegible]	26.575	17.992
423.00	37.290	32.128	23.331	19.252	[illegible]	31.519	26.773	18.178
423.20	37.489	32.325	23.515	19.422	[illegible]	31.718	26.971	18.358
423.40	37.687	32.517	23.679	19.557	6.584	31.917	27.160	18.507
423.60	37.881	32.700	23.816	19.660	6.608	32.114	27.353	18.626
423.80	38.064	32.865	23.927	19.739	6.622	32.302	27.518	18.714
424.00	38.237	33.011	24.015	19.798	6.631	32.480	27.663	18.774
424.20	38.404	33.143	24.088	19.853	6.639	32.649	27.793	18.826
424.40	38.568	33.271	24.161	19.908	6.648	32.815	27.919	18.876
424.60	38.732	33.401	24.238	19.964	6.658	32.986	28.058	18.928
424.80	38.902	33.538	24.325	20.038	6.668	33.165	28.196	18.992
425.00	39.084	33.695	24.439	20.129	6.691	33.355	28.369	19.091
425.20	39.276	33.873	24.592	20.276	6.749	33.552	28.561	19.237
425.40	39.474	34.063	24.768	20.447	6.827	33.750	28.757	19.414
425.60	39.678	34.251	24.929	20.588	6.888	33.949	28.950	19.573
425.80	39.859	34.422	25.049	20.675	6.908	34.142	29.125	19.676
426.00	40.039	34.577	25.149	20.747	6.914	34.325	29.280	19.746
426.20	40.222	34.734	25.268	20.844	6.941	34.508	29.437	19.827
426.40	40.406	34.897	25.381	20.955	6.976	34.692	29.606	19.927
426.60	40.583	35.054	25.486	21.040	6.996	34.858	29.748	20.003
426.80	40.745	35.187	25.564	21.093	7.006	34.988	29.849	20.049
427.00	40.898	35.305	25.630	21.141	7.016	35.108	29.929	20.088
427.20	41.046	35.418	25.698	21.186	7.025	35.208	29.999	20.123
427.40	41.189	35.525	25.745	21.228	7.032	35.298	30.063	20.154
427.60	41.326	35.624	25.797	21.266	7.037	35.374	30.121	20.181
427.80	41.460	35.728	25.847	21.308	7.042	35.454	30.176	20.207

* The units of u are molecules/cm^2, abbreviated here by (#/cm^2).

TABLE 7 (cont'd)

Sam. No.	173.	171.	170.	61.	56.	136.	133.	115.
Temp (K)	296.	296.	296.	296.	296.	338.	338.	338.
Path (cm)	59500.	59500.	59500.	2884.	420.	2884.	2884.	2884.
p (atm)	0.01145	0.00882	0.00553	0.02132	0.01579	0.02066	0.02066	0.02079
P (atm)	0.01145	0.00882	0.00553	0.02132	0.01579	1.00395	0.50000	0.02079
u (#/cm^2)*	1.690E 22	1.301E 22	8.158E 21	1.525E 21	1.645E 20	1.294E 21	1.294E 21	1.303E 21
ν (cm)$^{-1}$								
428.00	41.594	35.815	25.897	21.339	7.048	35.531	30.230	20.233
428.20	41.727	35.910	25.946	21.376	7.052	35.609	30.284	20.261
428.40	41.861	36.004	25.996	21.415	7.057	35.699	30.340	20.291
428.60	41.997	36.102	26.052	21.457	7.064	35.778	30.404	20.323
428.80	42.145	36.216	26.119	21.514	7.073	35.894	30.493	20.367
429.00	42.298	36.339	26.192	21.576	7.082	36.017	30.594	20.421
429.20	42.444	36.454	26.255	21.625	7.090	36.120	30.673	20.464
429.40	42.582	36.555	26.309	21.665	7.097	36.202	30.730	20.495
429.60	42.717	36.653	26.360	21.705	7.103	36.278	30.781	20.524
429.80	42.853	36.752	26.414	21.743	7.107	36.354	30.833	20.552
430.00	42.992	36.855	26.470	21.782	7.111	36.436	30.888	20.583
430.20	43.135	36.960	26.529	21.823	7.115	36.524	30.949	20.618
430.40	43.280	37.069	26.588	21.866	7.118	36.619	31.017	20.652
430.60	43.432	37.181	26.653	21.913	7.122	36.731	31.097	20.687
430.80	43.596	37.307	26.733	21.977	7.131	36.873	31.206	20.732
431.00	43.779	37.463	26.851	22.084	7.168	37.047	31.355	20.816
431.20	43.971	37.642	[illegible]	22.229	7.216	37.239	31.536	20.945
431.40	44.163	37.821	27.144	22.356	7.259	37.420	31.714	21.066
431.60	44.343	37.979	27.250	22.436	7.273	37.599	31.860	21.139
431.80	44.507	38.114	27.327	22.492	7.281	37.736	31.967	21.183
432.00	44.653	38.227	27.386	22.536	7.288	37.843	32.044	21.215
432.20	44.794	38.330	27.440	22.578	7.296	37.933	32.108	21.244
432.40	44.931	38.429	27.493	22.619	7.303	38.015	32.168	21.272
432.60	45.066	38.526	27.545	22.658	7.310	38.095	32.224	21.300
432.80	45.196	38.621	27.595	22.695	7.316	38.170	32.276	21.326
433.00	45.328	38.715	27.643	22.730	7.320	38.243	32.326	21.350
433.20	45.457	38.809	27.690	22.766	7.324	38.316	32.375	21.375
433.40	45.586	38.902	27.738	22.804	7.329	38.399	32.424	21.400
433.60	45.716	38.995	27.786	22.842	7.334	38.468	32.476	21.427
433.80	45.847	39.090	27.836	22.880	7.337	38.554	32.532	21.455
434.00	45.980	39.187	27.887	22.918	7.340	38.650	32.597	21.485
434.20	46.118	39.287	27.942	22.958	7.344	38.762	32.674	21.518
434.40	46.266	39.396	28.007	23.008	7.352	38.904	32.775	21.561
434.60	46.427	39.529	28.101	23.089	7.374	39.078	32.914	21.639
434.80	46.609	39.688	28.226	23.211	7.417	39.270	33.089	21.763
435.00	46.795	39.860	28.359	23.332	7.455	39.463	33.274	21.900
435.20	46.974	40.021	28.471	23.409	7.473	39.640	33.439	21.997
435.40	47.137	40.159	28.553	23.462	7.482	39.796	33.572	22.057
435.60	47.291	40.279	28.617	23.509	7.489	39.948	33.683	22.163
435.80	47.443	40.395	28.681	23.557	7.496	40.084	33.790	22.140
436.00	47.602	40.519	28.757	23.615	7.504	40.246	33.915	22.205
436.20	47.776	40.661	28.860	23.704	7.524	40.425	34.067	22.294
436.40	47.963	40.828	28.999	23.839	7.577	40.622	34.249	22.430
436.60	48.155	41.012	29.153	23.989	7.658	40.820	34.443	22.590
436.80	48.345	41.191	29.287	24.100	7.674	41.013	34.625	22.716
437.00	48.520	41.343	29.381	24.166	7.685	41.186	34.775	22.787
437.20	48.677	41.472	29.448	24.213	7.693	41.331	34.892	22.835
437.40	48.824	41.583	29.504	24.252	7.698	41.450	34.979	22.871
437.60	48.964	41.684	29.557	24.298	7.703	41.552	35.051	22.902
437.80	49.099	41.783	29.610	24.329	7.708	41.645	35.118	22.933
438.00	49.235	41.884	29.666	24.370	7.713	41.735	35.184	22.967
438.20	49.372	41.986	29.723	24.412	7.718	41.821	35.247	23.001
438.40	49.508	42.087	29.777	24.452	7.723	41.902	35.305	23.032
438.60	49.643	42.184	29.828	24.489	7.727	41.976	35.356	23.060
438.80	49.772	42.276	29.875	24.523	7.731	42.047	35.403	23.083
439.00	49.901	42.366	29.922	24.557	7.734	42.119	35.452	23.107
439.20	50.031	42.458	29.972	24.596	7.738	42.198	35.507	23.139
439.40	50.164	42.553	30.023	24.638	7.744	42.282	35.570	23.175
439.60	50.296	42.648	30.073	24.679	7.750	42.361	35.630	23.208
439.80	50.426	42.739	30.121	24.716	7.756	42.435	35.683	23.232
440.00	50.554	42.829	30.167	24.751	7.761	42.508	35.734	23.256
440.20	50.683	42.918	30.214	24.786	7.767	42.585	35.786	23.279
440.40	50.812	43.009	30.261	24.822	7.772	42.666	35.842	23.304
440.60	50.943	43.102	30.310	24.860	7.778	42.753	35.901	23.329
440.80	51.078	43.199	30.361	24.898	7.783	42.850	35.966	23.356
441.00	51.220	43.300	30.416	24.939	7.789	42.963	36.042	23.384
441.20	51.372	43.413	30.482	24.987	7.795	43.096	36.134	23.418
441.40	51.535	43.542	30.578	25.053	7.804	43.255	36.254	23.468
441.60	51.714	43.699	30.692	25.157	7.832	43.437	36.409	23.551
441.80	51.906	43.880	30.847	25.302	7.888	43.631	36.591	23.682
442.00	52.102	44.074	31.029	25.479	7.963	43.830	36.786	23.851
442.20	52.300	44.271	31.215	25.650	8.046	44.029	36.983	24.022
442.40	52.496	44.462	31.381	25.809	8.102	44.220	37.176	24.161
442.60	52.696	44.636	31.500	25.908	8.120	44.410	37.350	24.244
442.80	52.867	44.789	31.605	25.975	8.128	44.597	37.498	24.303
443.00	53.039	44.929	31.687	26.035	8.135	44.769	37.636	24.360
443.20	53.209	45.067	31.773	26.099	8.143	44.946	37.779	24.426
443.40	53.387	45.216	31.881	26.165	8.160	45.133	37.941	24.510
443.60	53.574	45.389	32.021	26.316	8.205	45.329	38.125	24.652
443.80	53.768	45.573	32.179	26.471	8.268	45.527	38.320	24.815
444.00	53.960	45.793	32.321	26.595	8.304	45.722	38.511	24.953

* The units of u are molecules/cm^2, abbraviated here by (#/cm^2).

SECTION 5

ABSORPTION BY CO_2 BETWEEN 500 AND 850 cm^{-1}

SAMPLING

The temperatures and total pressures of the samples studied were varied over wide ranges representative of the earth's atmosphere. Samples varied in pressure from 1 atm to less than 0.03 atm and were maintained near one of three different temperatures: 310 K, 274 K, and 245 K. The highest temperature corresponds approximately to the maximum atmospheric temperature in the tropics. The lowest temperature, 245 K, approximately represents stratospheric temperatures. Ideally, somewhat lower temperatures should be employed to cover the full temperature range of the atmosphere; however, the experimental difficulties associated with operating at lower temperatures would greatly increase the time involved in obtaining the data and would also reduce the accuracy. As a compromise, the lower temperature of 245 K was chosen. An intermediate temperature near 274 K was also employed in order to provide additional data on the temperature dependence of the absorption.

All of the samples studied were contained in a multiple-pass absorption cell that has been described previously[6]. The base length of the cell is 1 meter, and the optical path can be varied in increments of approximately 4 m up to a maximum of approximately 40 m. The number of passes of the monitoring beam can be adjusted externally without disturbing the sample in the cell. Electrical resistance wire coiled around the outside of the stainless steel body of the cell provides the heat when operating the cell above room temperature. The cell is well insulated so that only approximately 30 watts of power are required to maintain it at 310 K. When operating at this temperature, the gas in the cell is maintained uniform to less than $\pm$ 1 K. The temperature is controlled manually by adjusting the current through the heating wires.

The main body of the absorption cell is contained within a stainless steel tub that can be filled with liquid to submerge the cell. The intermediate temperature, 274 K, was maintained stable to $\pm$ 0.5 K by filling the tub with ice-water. The lower temperature, approximately 245 K, was attained by submerging the cell in a mixture of commercial "anti-freeze" and water that was chilled by bubbling liquid nitrogen through it. A piece of copper tubing submerged in the bottom of the tub that contained the anti-freeze mixture carried the liquid nitrogen from a large commercial dewar. Ten holes located at different places along the tubing allowed the nitrogen to evaporate and bubble from the tubing through the liquid. The movement of the bubbles mixed the liquid enough to maintain the temperature throughout the length of the absorption cell constant to approximately $\pm$ 1 K. The cell temperature was controlled by adjusting the rate of flow of the liquid nitrogen. After the cell temperature had been reasonably well stabilized, the temperature could be maintained constant to within $\pm$ 1 K for several hours. The low-temperature samples varied from approximately 243 to approximately 249 K. It was not important that all of the samples be at exactly the same temperature as long as

the temperature was measured accurately. Therefore, if the cell temperature was stabilized within this range, no effort was made to readjust the temperature. The stability of the optical system, and thus the accuracy of the data, are strongly dependent on temperature gradients and temperature changes in the cell.

A few of the data were obtained for samples of pure CO_2; most of the data represent samples of CO_2 mixed with dry air. The dry air consists of 79% N_2 and 21% O_2 to match the atmosphere. The mixtures of CO_2 plus dry air were obtained pre-mixed from a commercial gas supplier in cylinders at total pressures of approximately 150 atm. Table 8 lists the concentrations, in mole percent, of the different mixtures studied. The values of CO_2 concentration listed in the left-hand column are those determined spectroscopically by us in the laboratory before any spectral data were obtained; these values are the ones used in calculating the absorber thickness of the samples. The concentrations listed in the second column from the left are those provided by the gas supplier. Five of the eight measured concentrations agreed with the values provided by the gas supplier to within our measurement accuracy.

The concentration of each mixture was checked carefully by comparing its infrared absorption to that of a laboratory-mixed sample with very nearly the same concentration of CO_2. Samples used in these concentration measurements ordinarily varied in pressure from approximately 0.3 atm to 1 atm because pressures in this range can be measured quite accurately. The sample cell was at room temperature and was adjusted to either 4 or 8 passes in order to attain good stability. The spectrometer slits were adjusted wide to smooth out most of the structure in the spectrum over the short spectral interval used for the concentration measurements. The spectral interval was chosen so that the absorptance was nearly constant over the interval and was between approximately 0.4 and 0.7. With the absorptance in this range, the smallest fractional difference in the CO_2 concentration could be detected. Each measurement was repeated several times. Two separate batches of laboratory mixtures were made for each concentration, and the absorption by a given pressure of gas from each batch was compared. If the agreement between the measurements for a given concentration was not excellent, a new batch was made and the measurements were repeated.

The laboratory mixtures were made by introducing carefully measured amounts of CO_2 and dry air into a glass-lined mix-tank. The mix-tank is supplied with a small mixing blade that is driven from outside the tank by a drill motor. The shaft on which the mixing blade is mounted extends through a rotating seal that employs lubricated "O-rings". Partial pressures of the CO_2 and the dry air introduced into the mix tank could be measured with an accuracy of approximately 0.1 to 0.2%. The total pressure of the mixture was typically 10 atm. The estimated uncertainty in the values assigned to the concentrations for each of the laboratory mixtures varies from approximately 0.2% of the concentration for the higher concentrations to 0.5% for the lower concentrations. The laboratory-mixed samples were employed only to check the concentrations of the commercial mixtures, which were employed for all of the samples for which spectral data are presented.

No evidence of systematic error due to selective adsorption of CO_2 on the walls of the sample cell could be observed. The possibility of this phenomenon occurring was checked carefully for the most dilute (0.125% CO_2) mixture. Errors due to adsorption would probably be largest in the dilute samples. During the tests for adsorption, the infrared absorption at a fixed wavelength was measured, starting immediately after a sample had been introduced into the sample cell. Approximately one minute was required for the apparent absorption to stabilize because of the changing temperature of the gas as it expanded into a previously evacuated cell. After this short period of stabilization, the absorption by a sample remained constant for several days and was the same as the absorption by a sample of the same concentration that was flushed continuously through the cell. We concluded that no significant errors were being introduced by the adsorption and desorption of CO_2 from the cell walls. Some evidence of adsorption and desorption could be observed under extreme conditions that did not apply to our sampling procedures. For example, if the cell were filled with 1 atm of pure CO_2, then evacuated quickly to less than 1 torr of pressure, a slight increase in the infrared absorption could be observed for a few minutes after the valve to the pump was closed. This increase in absorption was apparently due to a small amount of CO_2 desorbing from the walls of the cell. However, we made certain that the cell was out-gassed before introducing a dilute mixture into the cell for investigation.

Three different gauges measured the sample pressures. A mercury manometer served for pressures between 0.1 and 1 atm, an oil manometer for pressures between approximately 0.003 and 0.1 atm, and a McLeod gauge for lower pressures. The parameters of the samples studied are summarized in Table 8. As explained above, the concentrations of the mixtures of CO_2 plus dry air used to determine sample absorber thicknesses are given in the left-hand column. Only a few data were obtained for samples of 100% CO_2; these are summarized in the upper portion of Table 8. The three right-hand columns of the table correspond to the three sample temperatures employed. For the 100% CO_2 samples, the pressures listed under a given temperature correspond to the samples for which spectral data were scanned. Not all of the samples of CO_2 plus dry air are represented in the table. A series of samples at different equivalent pressures were studied for each combination of path length and concentration. The maximum equivalent pressure for each series was 1.00 atm; each succeeding equivalent pressure was reduced by approximately a factor of two, giving pressures of 0.500, 0.250, 0.125 atm, etc. Only the lowest pressure is listed in Table 8 for the mixtures. In some cases, particularly for the lower pressures, the equivalent pressures were not adjusted to exactly an integral power of 0.5 atm; the measured pressures were used to calculate absorber thicknesses. The exact parameters for each sample are listed below in tables that include detailed results.

SPECTROSCOPIC PROCEDURES

The procedures employed in scanning the spectral data are essentially the same as those used to obtain the data presented in Sections 2 and 4. All of the optical path external to the sample cell passed either through a vacuum or through non-absorbing N_2 to eliminate absorption by CO_2 or any other atmospheric gas. The grating employed for the CO_2 data contains 40 grooves/mm and is blazed for maximum efficiency at 22 μm. All orders of wavelengths except for the first order were eliminated by a KBr prism.

TABLE 8. SUMMARY OF SAMPLES

% CO_2 (Measured)	% CO_2 (Gas Supplier)	Path Length (cm^{-1})	Minimum Equivalent Pressure (atm) Temperature 310K	274K	245K
	100*	3291	1.00*	1.00*	1.00*
	100	3291	0.500*	0.500*	
	100	3291	0.250*	0.250*	
	100	3291	0.125*		
	100	3291	0.00198*		
	100	3291	0.00393*		
15.3	15.3	3291	0.00198	0.00195	0.00193
8.09	8.09	3291	0.00197		
3.85	3.85	3291	0.00194	0.00192	0.00386
3.85	3.85	1648	0.00386		
1.91	1.91	1648	0.00781	0.00781	0.00781
0.977	0.977	1648	0.00779		
0.503	0.511	1648	0.0157	0.0157	0.0157
0.250	0.260	1648	0.0155		
0.125	0.128	1648	0.0313	0.0313	0.0313
0.125	0.128	826	0.0619	0.0625	0.0625

* The pure (100%) CO_2 samples are from a cylinder of commercial grade CO_2 with purity reportedly greater than 99.5%. The equivalent pressures listed for pure CO_2 represent all of the pure CO_2 samples studied. A series of samples at different equivalent pressures were studied for each combination of path length and concentration of the CO_2+ dry air mixtures. The equivalent pressures for each series were 1.00 atm, 0.500 atm, 0.250 atm, etc. down to the equivalent pressure tabulated.

A background curve that corresponded to 100% transmittance was scanned with the sample cell evacuated, either immediately before or after each sample spectrum was scanned. In order to check for possible sampling errors or changes in the signal level corresponding to 100% transmittance during a scan, portions of each spectrum were re-run and the results were compared with the spectrum that was to be reduced further. Separate samples having the same parameters were employed in the comparisons as further checks for possible sampling errors. Each sample spectrum and its corresponding background spectrum were digitized with the data related directly to detector signal punched on computer cards. A computer then calculated values of transmittance, integrated absorptance, etc.

The spectral slitwidth was adjusted wide enough to smooth out most of the structure due to individual vibration-rotation lines in the P- and R-branches of the bands. The Q-branches appear as single absorption features in the spectra. Smoothing the spectra in this manner simplifies the reduction and analysis of the data while maintaining adequate resolution for quantitative comparison with calculated spectra. The physical widths of both the entrance and exit slits of the grating monochromator were fixed at 1.7 mm. This resulted in the spectral slitwidth changing with wavenumber as given in Table 9. The values tabulated represent the full width at half-maximum of a triangular slit function. As can be seen in the transmittance curves shown below in this section, a small amount of structure remains in some of the P- and R-branches because of the individual lines. Slightly wider slits would have smoothed out this remaining structure as was originally intended. However, further widening the slits beyond the 1.7 mm used would have produced an irregular and unknown slit function for two reasons: The image of the Nernst glower source formed at the entrance slit was not sufficiently wide to illuminate a wider slit uniformly. In addition, the image of a wider exit slit formed on the detector would have overfilled the sensitive element of the detector. It is apparent that the outer portions of wider slits would not contribute properly to the detector signal, thus producing an irregular slit function. Interchanging or readjusting the optical components to overcome this problem so that wider slits could be used was not believed to be justified because of the small amount of undesired residual structure in the spectra.

A few checks were made on the uniformity of the sensitivity of the instrument to different narrow portions of the 1.7 mm wide slits that were used. The non-uniformities that were observed could lead to effective spectral slitwidths that differ by no more than 5 to 10% from the values listed in Table 9. Non-symmetry of the sensitivity about the center of the slit can also lead to slight shifts in the effective center of the spectral band passed by the slits. This phenomenon can lead to apparent shifts in the calibration that relates wavenumber to grating position as the slitwidth is changed. Errors in wavenumber calibration due to such non-uniformity in sensitivity could not be larger than 10% of the spectral slit width.

Table 10 lists the absorption lines used to provide wavenumber calibration. Transmission spectra of the calibration gases were scanned with the spectral slitwidths adjusted to about one-fourth of the values listed in Table 9. The calibration lines were well resolved with this improved resolution. The line positions were determined in terms of fiducial marks that were related directly

TABLE 9. RESOLUTION SCHEDULE

ν (cm^{-1})	Spectral Slitwidth (cm^{-1})
500	1.2
550	1.5
600	1.9
650	2.3
700	2.7
750	3.2
800	3.6
850	4.2

TABLE 10. CALIBRATION DATA

ν_o (cm^{-1})	Gas	ν_o (cm^{-1})	Gas
481.5	extrapolation	633.87	CO_2
494.19	H_2O	645.86	CO_2
506.93	H_2O	661.16	CO_2
519.60	H_2O	674.44	CO_2
525.98	H_2O	687.16	CO_2
536.26	H_2O	700.06	CO_2
547.83	H_2O	725.47	CO_2
554.64	H_2O	743.83	CO_2
567.23	H_2O	760.27	CO_2
576.14	H_2O	775.81	CO_2
584.74	H_2O	788.32	CO_2
594.96	H_2O	806.26	CO_2
604.46	H_2O	826.51	CO_2
620.59	H_2O	860.0	extrapolation

to grating position. It was assumed that the relationship between wavenumber and grating position remained fixed when the slits were widened to scan the spectral data. The errors introduced by making this assumption are essentially those caused by the non-uniformities in slit illumination discussed in the previous paragraph. The CO_2 line positions are well-known throughout most of the spectral region and were used from approximately 630 cm^{-1} to the high-wavenumber side of the band. All of the wavenumbers listed in Table 10 from 633.87 to 826.51 cm^{-1} correspond to the centers of CO_2 lines that are not "blended" with weaker adjacent lines enough to shift the apparent line centers significantly. The CO_2 line positions listed are from a report by Drayson.[13] No easily identifiable absorption line was available as a calibration standard near 850 cm^{-1}, the high wavenumber limit of the region of interest. Therefore, the position of a "false" line at 860.0 cm^{-1} on each spectrum was determined by extrapolation and used as a standard. Accurate calibration is not critical between 826 and 850 cm^{-1} because of the small amount of absorption and the lack of spectral structure in this region.

Absorption lines of H_2O were employed for the low-wavenumber side of the region. The H_2O lines used are reasonably well isolated from other lines so that the center positions can be located accurately and the points of maximum absorption are nearly independent of the slitwidth. Many of the CO_2 lines in the 490-625 cm^{-1} region are blended, making it difficult to determine their center positions accurately. All of the H_2O line positions from 494.19 to 620.59 cm^{-1} are from unpublished data provided by W. S. Benedict and R. F. Calfee.[14] The values listed for these lines agree within a few hundredths of a cm^{-1} with the corresponding values in the AFGL listing of line parameters (Ref. 1). The "false" line at 481.5 cm^{-1} was located by extrapolation in the same manner as that used for the 860.0 cm^{-1} line. A spectrum of N_2O was scanned, and the known positions of the lines were used to confirm the positions of the H_2O lines between 590 and 634 cm^{-1}. The 6.3 μm H_2O band was scanned in 2nd order and its line positions used to confirm the calibration from 670 to 730 cm^{-1}.

Before each recorded spectrum was digitized, the positions of the calibration lines were marked on the recording. During the digitizing process, the positions of these calibration lines were also digitized in terms of their physical position on the recording. Wavenumber positions between the calibration lines were computed by interpolating on a linear wavenumber scale. The maximum error introduced by the assumption of a linear wavenumber scale was

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[13] S. R. Drayson, "A Listing of Wavenumbers and Intensities of Carbon Dioxide Absorption Lines Between 12 and 20 μm." Technical Report 036350-4-T, National Aeronautics and Space Administration, Contract No. NSR 23-005-376, May 1973.

[14] W. S. Benedict, Inst. for Molecular Physics, College Park Maryland, 90742; R. Calfee, Wave Propogation Labs., Environmental Research Labs. National Oceanic Atmospheric Administration, Boulder Colorado 80302, (Private Communication).

approximately 0.1 cm^{-1}. The estimated total error in wavenumber calibration is less than 0.2 cm^{-1} for most of the spectrum, but it may be as large as 0.4 cm^{-1} in a few places.

RESULTS

The results of the CO_2 transmission measurements are presented in detail in the form of tables of integrated absorptance, $\int A d\nu$, and in spectral plots of transmittance. Tables 12 through 27 contain extensive lists of the cumulative value of the integral $\int A d\nu$. Table 11 summarizes the samples represented and the wavenumber interval covered by Tables 12 - 27. The table is divided into three sections, one section for each temperature. The first letter of each sample number identifies the temperature as follows: H, 310K; Z, 274K; L, 245K. The second letter identifies a group of samples for which the corresponding spectra were processed together. Several groups may cover the same spectral region, and the data appear in a single table. As examples, HB01, 2 refers to two samples: HB01 and HB02; HC01-3 refers to samples HC01-3 refers to samples HC01, HC02 and HC03. The two right-hand columns of each section of Table 11 lists the number of the table that the integral values appear and the figure number that the spectra appear for each sample.

Each column in Tables 12 - 27 corresponds to a given sample with the sample parameters listed at the top of the column. The molar concentrations of CO_2 in the mixtures with dry air are listed along with temperature, path length, total pressure, equivalent pressure P_e (see Equation (8)), and absorber thickness. The pressures were originally measured in torr, and the values were submitted to the computer with the appropriate number of significant figures. Values of the pressures were computed in atm and listed in the table without rounding them off to the corresponding number of significant figures. For the same reason, many values of absorber are also listed to more than the significant number of figures.

The lower limit of integration, ν', is lower for large samples that absorb a measurable amount far into the wings of the band system that it is for small samples. The tabulated value for a given wavenumber ν represents the value of the integral from ν' up to ν. Successive values of ν differ by 2 cm^{-1}; the maximum value of ν listed depends on the amount of absorption by the sample. Several samples absorb a small, but measurable amount beyond the spectral limits included in Tables 12 - 27. The data for these samples have been omitted in the wings of the band system because data for larger samples provide more accurate checks on line parameters. When the absorptance is small, very slight errors in placing the 100% transmittance curve can result in large relative errors in the apparent line intensities.

The integrated absorptance between any two wavenumbers listed in Tables 12 - 27 is equal to the difference between the tabulated values of the integral. Some deviation from the true integrated absorptance that would be observed with infinite resolving power occurs because of the finite slitwidth employed in scanning the spectra. Enough significant figures are carried in the integral values so that the difference between two successive values retains all of the significant figures justified by the accuracy of the original data.

Computer plots of transmittance for the samples are shown in Figures 10-24. The spectral resolution is the same as that of the original spectra (Table 9) that were scanned and recorded by a strip-chart recorder. Only three of the parameters for each sample are given in the figures. The listings appear in the same order, top to bottom, as the spectral curves. Values of absorber thickness ν are expressed in exponential form. For example, 1.528E 18 indicates 1.528×10^{18} molecules/cm^2. All of the samples represented in Figures 10 - 16 were near 310K; Figures 17 - 20, near 274K; and Figures 21 - 24, near 245K.

Values of P_e and P are related by Equation (8) with B = 1.30; these two values of pressure approach each other for very dilute mixtures of CO_2 in dry air. In a few spectral regions within the band system, a significant portion of the absorption may be due to the extreme wings of distant lines. In these cases the value of B = 1.30 on which P_e is based may not be appropriate (see Reference 3). The path lengths and CO_2 concentrations are not given in Figures 16 - 24, but they can be found in the headings of Tables 12 - 27.

TABLE 11. SUMMARY OF TABLES AND FIGURES

301 K			
Sample No.	$\nu_o - \nu_L$ (cm^{-1})	Table No.	Fig. No.
HØ01,2	560-780	12	10
HA01			10
HB01,2			10
HC01-3			10
HD01-4			10
HE01-5			11
HF01-6	560-780	13	11
HG01-7			13
HH01-8	590-750	14	12,13
HI01-9			12
HJ01-10	610-735	15	14
HK01-9			14,15
HL01-8	610-735	16	15
HM01-5	656-680		10
HN01-3	656-680		10
HP01-2,3,4,6,8	500-560	17	16
HP01-5,7,9			
HQ01-2,3,4,6,8	780-850	18	16
HQ01-5,7			

274 K			
Sample No.	$\nu_o - \nu_L$ (cm^{-1})	Table No.	Fig. No.
ZA01	560-780	19	17
ZB02			17
ZC01,3			17
ZD02,4			17
ZE01,3,5			17
ZF02,4,6			18
ZG01,3,5,7	590-750		19
ZH02,4,6,8	590-750	20	19
ZI01,3,5,7,9			19
ZJ01,2,4,6,8,10	610-735		18
ZK01,2,4,6,8	610-735	21	17
ZL01,2,4,6,8			17
ZM01,2,4	656-680		17
ZN01,2			18
ZP01-6	500-560	22	20
ZQ01-6	780-850	23	20

245 K			
Sample No.	$\nu_o - \nu_L$ (cm^{-1})	Table No.	Fig. No.
LA01	560-780	24	21
LB02			21
LC01,3			21
LD02,4			21
LE01,3,5			21
LF02,4,6			22
LG01,3,5,7	590-750		23
LH02,4,6,8	590-750	25	23
LI01,3,5,7,9			23
LJ01,2,4,6,8,10	610-735		22
LK01,2,4,6,8	610-735	26	21
LL01,2,4,6			21
LM01,2,4	656-680		21
LN01,2			22
LP01	500-560	27	24
LQ01	780-850	27	24

TABLE 12 $\int_{\nu'}^{\nu} A\,d\nu$

Sam. No.	HF01	HF02	HA01	HB01	HB02	HC01
Temp (K)	310.	310.	310.	310.	310.	310.
Path (cm)	3291.	3291.	3291.	3291.	3291.	3291.
Conc.	1.00000	1.00000	0.15300	0.08090	0.15300	0.03850
P (atm)	0.001526	0.003026	0.955263	0.976316	0.477632	0.988158
P_e (atm)	0.001984	0.003934	0.999110	1.000011	0.499555	0.999571
u (#/cm^2)*	1.190E 20	2.359E 20	1.139E 22	6.158E 21	5.697E 21	2.966E 21
ν (cm^{-1})						
560.00	0.	0.	0.	0.	0.	0.
562.00	0.	0.	0.363	0.196	0.172	0.099
564.00	0.	0.002	0.794	0.443	0.338	0.221
566.00	0.	0.016	1.319	0.744	0.658	0.371
568.00	0.	0.032	1.936	1.113	0.936	0.560
570.00	0.	0.052	2.692	1.591	1.390	0.835
572.00	0.	0.067	3.504	2.115	1.847	1.095
574.00	0.	0.086	4.401	2.709	2.356	1.442
576.00	0.	0.105	5.421	3.423	2.956	1.875
578.00	0.	0.129	6.601	4.281	3.681	2.419
580.00	0.013	0.161	7.899	5.241	4.470	3.049
582.00	0.023	0.207	9.399	6.464	5.472	3.895
584.00	0.041	0.255	11.045	7.765	6.594	4.532
586.00	0.063	0.292	12.679	9.097	7.666	5.776
588.00	0.092	0.333	14.413	10.524	8.942	6.836
590.00	0.104	0.379	16.228	12.070	10.120	7.995
592.00	0.129	0.425	18.090	13.689	11.464	9.247
594.00	0.151	0.479	20.007	15.404	12.928	10.635
596.00	0.191	0.544	21.969	17.234	14.569	12.144
598.00	0.260	0.782	23.969	19.193	16.459	13.956
600.00	0.299	0.779	25.965	21.089	18.197	15.603
602.00	0.324	0.834	27.953	22.967	19.891	17.210
604.00	0.354	0.891	29.953	24.976	21.620	18.879
606.00	0.391	0.945	31.953	26.907	23.409	20.608
608.00	0.433	1.013	33.953	28.760	25.248	22.370
610.00	0.477	1.087	35.953	30.719	27.102	24.159
612.00	0.516	1.159	37.953	32.688	28.975	25.963
614.00	0.565	1.232	39.953	34.664	30.869	27.737
616.00	0.655	1.369	41.953	36.653	32.811	29.637
618.00	0.900	1.793	43.953	38.653	34.811	31.677
620.00	1.696	2.107	45.953	40.644	36.772	33.603
622.00	1.152	2.154	47.953	42.602	38.698	35.397
624.00	1.214	2.252	49.953	44.579	40.506	37.269
626.00	1.283	2.404	51.953	46.576	42.476	39.232
628.00	1.359	2.542	53.953	48.576	44.473	41.227
630.00	1.452	2.703	55.953	50.576	46.473	43.227
632.00	1.561	2.897	57.953	52.576	48.473	45.227
634.00	1.679	3.113	59.953	54.576	50.473	47.227
636.00	1.804	3.349	61.953	56.576	52.473	49.227
638.00	1.939	3.602	63.953	58.576	54.473	51.227
640.00	2.097	3.979	65.953	60.576	56.473	53.227
642.00	2.244	4.175	67.953	62.576	58.473	55.227
644.00	2.415	4.494	69.953	64.576	60.473	57.227
646.00	2.596	4.835	71.953	66.576	62.473	59.227
648.00	2.942	5.293	73.953	68.576	64.473	61.227
650.00	3.272	6.027	75.953	70.576	66.473	63.227
652.00	3.598	6.406	77.953	72.576	68.473	65.227
654.00	3.862	7.059	79.953	74.576	70.473	67.227
656.00	4.095	7.547	81.953	76.576	72.473	69.227
658.00	4.321	7.986	83.953	78.576	74.473	71.227

Sam. No.	HC02	HC03	HD01	HD02	HD03	HD04
Temp (K)	310.	310.	310.	310.	310.	310.
Path (cm)	3291.	3291.	1648.	3291.	3291.	3291.
Conc.	0.08090	0.15300	0.03850	0.01850	0.08090	0.15300
P (atm)	0.488158	0.238816	0.986816	0.493421	0.244079	0.119737
P_e (atm)	0.500005	0.249777	1.000237	0.499120	0.250003	0.125233
u (#/cm^2)*	3.074E 21	2.849E 21	1.486E 21	1.481E 21	1.539E 21	1.428E 21
ν (cm^{-1})						
560.00	0.	0.	0.	0.	0.	0.
562.00	0.109	0.098	0.045	0.053	0.049	0.055
564.00	0.237	0.216	0.114	0.105	0.100	0.114
566.00	0.389	0.359	0.193	0.172	0.171	0.190
568.00	0.579	0.532	0.299	0.267	0.271	0.279
570.00	0.827	0.752	0.419	0.394	0.396	0.399
572.00	1.105	1.002	0.577	0.547	0.538	0.516
574.00	1.431	1.295	0.777	0.723	0.697	0.662
576.00	1.829	1.626	1.023	0.949	0.903	0.941
578.00	2.321	2.044	1.343	1.243	1.163	1.361
580.00	2.860	2.493	1.717	1.576	1.441	1.297
582.00	3.609	3.087	2.242	2.041	1.844	1.625
584.00	4.394	3.749	2.845	2.574	2.269	1.936
586.00	5.191	4.382	3.471	3.132	2.709	2.325
588.00	6.074	5.084	4.189	3.701	3.203	2.720
590.00	7.038	5.848	4.997	4.365	3.745	3.137
592.00	8.092	6.676	5.894	5.094	4.337	3.595
594.00	9.232	7.602	6.898	5.907	5.002	4.101
596.00	10.576	8.760	8.054	6.890	5.862	4.795
598.00	12.269	10.312	9.597	8.298	7.137	5.935
600.00	13.676	11.476	10.924	9.386	7.967	6.626
602.00	15.026	12.575	12.172	10.355	8.750	7.227
604.00	16.462	13.749	13.490	11.459	9.601	7.392
606.00	17.968	14.997	14.867	12.596	10.518	8.593
608.00	19.550	16.333	16.310	13.903	11.508	9.372
610.00	21.146	17.678	17.771	15.037	12.506	10.160
612.00	22.763	19.039	19.242	16.273	13.519	10.955
614.00	24.407	20.436	20.729	17.529	14.561	11.783
616.00	26.207	22.052	22.367	19.012	15.832	12.910
618.00	28.175	23.987	24.299	20.939	17.731	14.652
620.00	29.976	25.634	26.056	22.494	19.094	15.365
622.00	31.559	26.986	27.549	23.767	20.134	16.703
624.00	33.291	28.494	29.222	25.730	21.367	17.695
626.00	35.171	30.199	31.063	26.901	22.820	19.375
628.00	37.132	32.050	33.002	28.727	24.449	20.229
630.00	39.125	33.939	34.980	30.646	26.226	21.735
632.00	41.125	35.959	36.976	32.604	28.055	23.383
634.00	43.125	37.947	38.976	34.579	29.994	25.124
636.00	45.125	39.945	40.976	36.564	31.926	26.913
638.00	47.125	41.945	42.976	38.567	33.893	28.751
640.00	49.125	43.945	44.976	40.567	35.858	30.633
642.00	51.125	45.945	46.976	42.567	37.929	32.595
644.00	53.125	47.945	48.976	44.567	39.911	34.401
646.00	55.125	49.945	50.976	46.567	41.900	36.319
648.00	57.125	51.945	52.976	48.567	43.796	38.259
650.00	59.125	53.945	54.976	50.567	45.796	40.250
652.00	61.125	55.945	56.976	52.567	47.796	42.246
654.00	63.125	57.945	58.976	54.567	49.796	44.247
656.00	65.125	59.945	60.976	56.567	51.796	46.236
658.00	67.125	61.945	62.976	58.567	53.796	48.279

Sam. No.	HE01	HE02	HE03	HE04	HE05
Temp (K)	310.	310.	310.	310.	310.
Path (cm)	1648.	1648.	3291.	3291.	3291.
Conc.	0.01910	0.01850	0.03850	0.08090	0.15300
P (atm)	0.994737	0.494079	0.247368	0.121711	0.059737
P_e (atm)	1.001417	0.499786	0.250226	0.124664	0.062479
u (#/cm^2)*	7.417E 20	7.426E 20	7.425E 20	7.476E 20	7.125E 20
ν (cm^{-1})					
560.00	0.	0.	0.	0.	0.
562.00	0.020	0.019	0.045	0.003	0.016
564.00	0.059	0.049	0.098	0.036	0.052
566.00	0.106	0.099	0.144	0.067	0.099
568.00	0.162	0.140	0.199	0.104	0.130
570.00	0.230	0.202	0.264	0.163	0.199
572.00	0.315	0.283	0.340	0.227	0.259
574.00	0.421	0.382	0.441	0.313	0.337
576.00	0.553	0.510	0.563	0.418	0.429
578.00	0.731	0.679	0.727	0.556	0.543
580.00	0.941	0.870	0.910	0.701	0.667
582.00	1.246	1.145	1.160	0.913	0.849
584.00	1.609	1.465	1.450	1.139	1.047
586.00	1.999	1.800	1.736	1.364	1.221
588.00	2.463	2.183	2.064	1.627	1.429
590.00	3.000	2.611	2.426	1.922	1.657
592.00	3.613	3.059	2.829	2.236	1.879
594.00	4.305	3.631	3.276	2.591	2.149
596.00	5.139	4.290	3.840	3.073	2.520
598.00	6.375	5.371	4.527	3.379	3.260
600.00	7.379	6.179	5.444	4.356	3.665
602.00	8.299	6.985	5.991	4.761	3.936
604.00	9.275	7.646	6.562	5.205	4.336
606.00	10.305	8.453	7.221	5.690	4.771
608.00	11.397	9.315	7.909	6.221	5.149
610.00	12.443	10.191	8.512	6.763	5.595
612.00	13.574	11.069	9.317	7.306	6.019
614.00	14.674	11.962	10.047	7.972	6.476
616.00	15.961	13.060	11.036	8.691	7.159
618.00	17.799	14.759	12.726	10.221	8.541
620.00	19.296	16.183	13.853	11.260	9.521
622.00	20.443	17.125	14.631	11.952	10.091
624.00	21.915	19.266	15.564	12.561	10.573
626.00	23.418	19.626	16.693	13.439	11.279
628.00	25.199	21.172	17.992	14.460	12.191
630.00	27.060	22.870	19.456	15.635	13.049
632.00	28.936	24.671	21.051	16.967	14.142
634.00	30.941	26.536	22.752	18.413	15.352
636.00	32.913	28.434	24.503	19.929	16.641
638.00	34.899	30.362	26.309	21.529	18.018
640.00	36.899	32.322	28.167	23.192	19.460
642.00	38.899	34.283	30.021	24.857	20.999
644.00	40.899	36.251	31.899	25.543	22.396
646.00	42.899	38.231	33.802	28.291	23.913
648.00	44.893	40.222	35.735	30.074	25.519
650.00	46.899	42.222	37.721	32.316	27.364
652.00	48.898	44.222	39.710	33.952	29.206
654.00	50.899	46.222	41.695	35.991	31.016
656.00	52.899	48.222	43.682	37.903	32.913
658.00	54.899	50.222	45.666	39.721	34.549

660.00	4.533	8.407	85.953	80.576	76.473	73.227	69.125	63.945	64.976	60.567	55.796	50.215	55.899	52.222	47.649	41.637	36.375
662.00	4.752	8.827	87.953	82.576	78.473	75.227	71.125	65.945	66.976	62.567	57.796	52.207	58.899	54.222	49.629	43.547	38.143
664.00	5.129	9.464	89.953	84.575	80.473	77.227	73.125	67.945	68.976	64.567	59.796	54.197	60.899	56.222	51.612	45.491	39.975
666.00	5.421	10.024	91.953	86.576	82.473	79.227	75.125	69.945	70.976	66.567	61.796	56.197	62.899	58.222	53.604	47.439	41.845
668.00	6.022	10.543	93.953	88.576	84.473	81.227	77.125	71.945	72.976	68.567	63.796	58.197	64.899	60.222	55.599	49.481	43.727
670.00	7.204	12.367	95.953	90.576	86.473	83.227	79.125	73.945	74.976	70.567	65.796	60.197	66.899	62.222	57.599	51.399	45.714
672.00	7.691	13.227	97.953	92.576	88.473	85.227	81.125	75.945	76.976	72.567	67.796	62.197	68.899	64.222	59.599	53.399	47.665
674.00	7.959	13.715	99.953	94.576	90.473	87.227	83.125	77.945	78.976	74.567	69.796	64.197	70.899	66.222	61.595	55.336	49.517
676.00	8.244	14.199	101.953	96.576	92.473	89.227	85.125	79.945	80.976	76.567	71.796	66.197	72.899	68.222	63.585	57.276	51.337
678.00	8.451	14.661	103.953	98.576	94.473	91.227	87.125	81.945	82.976	78.567	73.796	68.197	74.899	70.222	65.579	59.211	53.156
680.00	8.704	15.143	105.953	100.576	96.473	93.227	89.125	83.945	84.976	80.567	75.796	70.197	76.899	72.222	67.570	61.145	54.967
682.00	8.953	15.620	107.953	102.576	98.473	95.227	91.125	85.945	86.976	82.567	77.796	72.197	78.899	74.222	69.562	63.074	56.759
684.00	9.201	16.092	109.953	104.576	100.473	97.227	93.125	87.945	88.976	84.567	79.796	74.197	80.899	76.222	71.554	64.995	58.540
686.00	9.444	16.552	111.953	106.576	102.473	99.227	95.125	89.945	90.976	86.567	81.796	76.194	82.899	78.222	73.541	66.899	60.295
688.00	9.653	16.955	113.953	108.576	104.473	101.227	97.125	91.945	92.976	88.567	83.796	78.179	84.899	80.222	75.523	68.775	62.005
690.00	9.895	17.396	115.953	110.576	106.473	103.227	99.125	93.945	94.976	90.567	85.796	80.159	86.899	82.222	77.502	70.660	63.716
692.00	10.159	17.826	117.953	112.576	108.473	105.227	101.125	95.945	96.976	92.567	87.796	82.132	88.899	84.222	79.470	72.534	65.463
694.00	10.295	18.176	119.953	114.576	110.473	107.227	103.125	97.945	98.976	94.567	89.795	84.075	90.899	86.221	81.405	74.320	67.073
696.00	10.449	18.490	121.953	116.576	112.473	109.227	105.125	99.945	100.976	96.567	91.792	85.995	92.899	88.205	83.332	76.042	68.539
698.00	10.539	18.747	123.953	118.576	114.473	111.227	107.125	101.945	102.976	98.567	93.756	87.959	94.899	90.175	85.160	77.690	70.059
700.00	10.716	18.991	125.953	120.576	116.473	113.227	109.125	103.945	104.976	100.567	95.716	89.691	96.899	92.133	86.991	79.269	71.369
702.00	10.834	19.214	127.953	122.576	118.473	115.227	111.125	105.945	106.976	102.567	97.672	91.505	98.899	94.081	88.760	80.924	72.691
704.00	10.959	19.449	129.953	124.576	120.473	117.227	113.125	107.945	108.976	104.565	99.615	93.301	100.889	96.005	90.545	82.341	73.965
706.00	11.065	19.645	131.953	126.576	122.473	119.227	115.125	109.927	110.976	106.539	101.476	94.957	102.853	97.859	92.176	83.695	75.091
708.00	11.171	19.907	133.953	128.576	124.473	121.227	117.125	111.890	112.976	108.454	103.257	96.475	104.752	99.626	93.666	84.992	76.069
710.00	11.227	19.952	135.953	130.576	126.473	123.227	119.122	113.997	114.965	110.357	104.977	97.970	106.662	101.326	95.079	85.991	76.967
712.00	11.302	20.089	137.953	132.576	128.473	125.227	121.097	115.691	116.927	112.250	106.614	99.295	108.472	102.925	96.349	87.010	77.731
714.00	11.386	20.209	139.953	134.576	130.474	127.213	123.015	117.481	118.822	113.976	108.090	100.516	110.154	104.372	97.553	87.916	78.515
716.00	11.429	20.315	141.953	136.576	132.439	129.175	124.852	119.133	120.616	115.562	109.470	101.697	111.657	105.657	98.576	88.710	79.159
718.00	11.499	20.433	143.953	138.576	134.402	131.119	126.616	120.749	122.338	117.154	110.779	102.703	113.152	106.859	99.623	89.514	79.326
720.00	11.633	20.707	145.953	140.576	136.398	133.097	128.636	122.639	124.293	118.995	112.511	104.234	114.876	108.494	101.144	90.954	81.939
722.00	11.893	21.173	147.953	142.575	138.337	135.071	130.567	124.508	126.195	120.343	114.277	105.352	116.709	110.255	102.763	92.393	82.361
724.00	11.935	21.324	149.953	144.542	140.263	136.990	132.199	125.960	127.699	122.151	115.379	106.328	117.992	111.293	103.591	93.045	82.998
726.00	12.034	21.380	151.953	146.471	142.040	138.569	133.643	127.164	129.010	123.241	116.246	107.615	118.913	112.343	104.193	93.530	83.371
728.00	12.076	21.440	153.953	148.397	143.913	140.263	135.117	128.395	130.353	124.365	117.149	108.317	119.792	112.935	104.925	93.993	83.769
730.00	12.117	21.507	155.953	150.335	145.611	141.999	136.628	129.652	131.745	125.531	118.096	109.059	120.336	113.673	105.435	94.501	84.134
732.00	12.159	21.565	157.953	152.287	147.425	143.742	138.160	130.931	133.178	126.716	119.049	109.903	121.916	114.533	106.172	95.025	84.602
734.00	12.210	21.627	159.953	154.236	149.252	145.507	139.700	132.204	134.625	127.904	119.391	110.547	123.014	115.356	106.947	95.544	85.019
736.00	12.241	21.689	161.953	156.194	151.091	147.279	141.238	133.461	136.070	129.091	120.915	111.255	124.109	116.249	107.512	96.034	85.420
738.00	12.293	21.757	163.953	158.154	152.926	149.054	142.751	134.746	137.516	130.269	121.460	112.003	125.199	117.102	108.170	96.539	85.457
740.00	12.331	21.947	165.953	160.124	154.814	150.556	144.419	136.141	139.007	131.530	122.931	112.944	126.317	118.006	108.921	97.122	86.321
742.00	12.414	22.001	167.953	162.104	156.745	152.724	146.171	137.706	140.640	132.955	124.132	113.926	127.639	119.135	109.925	97.954	87.027
744.00	12.490	22.123	169.945	163.999	158.573	154.446	147.674	139.027	142.097	134.251	125.192	114.337	128.836	120.150	110.739	98.602	87.629
746.00	12.522	22.170	171.901	165.793	160.069	155.924	148.864	139.968	143.226	135.130	125.947	115.350	129.656	120.798	111.178	98.943	87.917
748.00	12.552	22.212	173.329	167.506	161.544	157.319	149.995	140.965	144.270	135.952	126.458	115.941	130.443	121.365	111.622	99.266	88.179
750.00	12.576	22.249	175.718	169.167	162.976	158.639	151.078	141.737	145.243	136.730	127.163	116.311	131.131	121.900	112.043	99.590	88.436
752.00	12.604	22.287	177.562	170.754	164.346	159.873	152.101	142.568	146.136	137.459	127.624	116.764	131.754	122.396	112.435	99.873	88.652
754.00	12.626	22.327	179.355	172.257	165.626	161.025	153.052	143.343	146.942	138.124	128.146	117.156	132.303	122.847	112.903	100.157	88.911
756.00	12.645	22.367	181.095	173.679	166.845	162.094	153.939	144.074	147.669	138.735	128.635	117.539	132.782	123.256	113.140	100.410	89.129
758.00	12.671	22.417	182.794	175.042	168.042	163.091	154.755	144.813	148.341	139.322	129.125	118.011	133.213	123.636	113.470	100.675	89.367
760.00	12.697	22.459	184.295	176.177	169.022	163.854	155.465	145.408	148.965	139.784	129.495	118.347	133.548	123.939	113.727	100.976	89.555
762.00	12.700	22.491	185.592	177.120	169.593	164.529	156.044	145.871	149.273	140.154	129.790	118.602	133.803	124.169	113.927	101.032	89.697
764.00	12.714	22.527	186.741	177.944	170.436	165.073	156.470	146.293	149.610	140.467	130.022	118.829	134.072	124.361	114.103	101.170	89.829
766.00	12.727	22.547	187.793	178.685	171.175	165.548	156.894	146.647	149.936	140.734	130.250	119.038	134.166	124.515	114.256	101.291	89.943
768.00	12.733	22.573	188.732	179.362	171.692	165.943	157.251	146.975	150.124	140.957	130.413	119.210	134.304	124.641	114.394	101.394	90.044
770.00	12.734	22.599	189.757	179.980	172.246	166.292	157.575	147.253	150.325	141.147	130.571	119.367	134.415	124.749	114.490	101.427	90.129
772.00	12.734	22.622	190.671	180.532	172.766	166.592	157.969	147.568	150.493	141.312	130.707	119.513	134.516	124.837	114.531	101.55[illegible]	90.211
774.00	12.734	22.642	191.451	180.992	173.230	166.829	158.106	147.806	150.623	141.443	130.810	119.637	134.596	124.907	114.660	101.639	[illegible]
776.00	12.734	22.665	192.071	181.341	173.543	167.015	158.259	147.996	150.727	141.543	130.896	119.735	134.660	124.970	114.723	101.659	[illegible]
778.00	12.734	22.685	192.539	181.640	173.826	167.169	158.456	148.155	150.817	141.622	130.972	119.815	134.707	125.025	114.773	101.703	[illegible]
780.00	12.734	22.701	193.048	181.905	174.070	167.299	158.587	149.297	150.897	141.680	131.038	119.990	134.754	125.073	114.814	101.74[illegible]	90.[illegible]46

* The units of u are molecules/cm^2, abbreviated here by (#/cm^2)

TABLE 13 $\int_{\nu_0}^{\nu} A\,d\nu$

Sam. No.	HF01	HF02	HF03	HF04	HF05	HF06	HG01	HG02	HG03	HG04	HG05	HG06	HG07
Temp (K)	310.	310.	310.	310.	310.	310.	310.	310.	310.	310.	310.	310.	310.
Path (cm)	1648.	1648.	1648.	3291.	3291.	3291.	1648.	1648.	1648.	1648.	3291.	3291.	3291.
Conc.	0.00977	0.01910	0.03850	0.03850	0.08090	0.15300	0.00503	0.00977	0.01910	0.03850	0.03850	0.08090	0.15300
P (atm)	0.997368	0.497368	0.247368	0.123684	0.061053	0.029868	1.000000	0.498684	0.248684	0.123684	0.061842	0.030526	0.014868
P_e (atm)	1.000292	0.500218	0.250226	0.125113	0.062534	0.031239	1.001509	0.500146	0.250109	0.125113	0.062556	0.031267	0.015551
u (#/cm²)*	3.804E 20	3.709E 20	3.718E 20	3.712E 20	3.851E 20	3.563E 20	1.964E 20	1.902E 20	1.854E 20	1.859E 20	1.856E 20	1.925E 20	1.774E 20
ν (cm^{-1})													
560.00	0.	0.	0.	0.	0.	0.							
562.00	0.028	0.023	0.033	0.	0.	0.005							
564.00	0.059	0.052	0.061	0.	0.000	0.036							
566.00	0.088	0.074	0.093	0.003	0.013	0.072							
568.00	0.119	0.108	0.125	0.031	0.038	0.111							
570.00	0.158	0.149	0.169	0.066	0.071	0.152							
572.00	0.208	0.189	0.225	0.103	0.115	0.195							
574.00	0.263	0.239	0.294	0.159	0.181	0.252							
576.00	0.333	0.305	0.353	0.217	0.254	0.315							
578.00	0.433	0.396	0.445	0.294	0.343	0.385							
580.00	0.546	0.506	0.554	0.397	0.430	0.457							
582.00	0.713	0.664	0.702	0.517	0.555	0.564							
584.00	0.918	0.851	0.877	0.663	0.688	0.681							
586.00	1.146	1.059	1.056	0.806	0.807	0.752							
588.00	1.429	1.307	1.264	0.956	0.942	0.906							
590.00	1.770	1.593	1.495	1.116	1.091	1.039	0.	0.	0.	0.	0.	0.	0.
592.00	2.168	1.914	1.749	1.300	1.259	1.173	0.250	0.210	0.173	0.122	0.109	0.088	0.060
594.00	2.628	2.278	2.036	1.523	1.449	1.324	0.538	0.447	0.368	0.264	0.232	0.183	0.128
596.00	3.197	2.733	2.413	1.822	1.700	1.535	0.903	0.749	0.615	0.446	0.396	0.317	0.235
598.00	4.120	3.528	3.118	2.426	2.231	1.972	1.546	1.305	1.089	0.839	0.744	0.60[illegible]	0.474
600.00	4.842	4.082	3.538	2.755	2.502	2.183	2.029	1.692	1.382	1.064	0.920	0.740	0.592
602.00	5.489	4.572	3.906	3.032	2.725	2.359	2.462	2.028	1.631	1.239	1.065	0.851	0.672
604.00	6.181	5.100	4.297	3.326	2.967	2.550	2.934	2.350	1.898	1.432	1.222	0.968	0.772
606.00	6.911	5.659	4.721	3.645	3.229	2.757	3.432	2.774	2.191	1.642	1.390	1.095	0.875
608.00	7.674	6.252	5.177	3.995	3.513	2.989	3.951	3.178	2.501	1.873	1.576	1.239	0.992
610.00	8.449	[illegible]	5.646	4.359	3.805	3.225	4.473	3.590	2.819	2.113	1.774	1.384	1.114
612.00	9.213	[illegible]	6.112	4.719	4.102	3.458	4.974	3.988	3.124	2.341	1.968	1.527	1.238
614.00	9.967	[illegible]	6.588	5.099	4.408	3.709	5.455	4.387	3.441	2.583	2.170	1.682	1.373
616.00	10.871	[illegible]	7.270	5.698	4.913	4.118	6.040	4.907	3.901	2.947	2.503	1.959	1.606
618.00	12.493	10.396	8.734	7.057	6.138	5.168	7.389	6.204	5.128	4.003	3.453	2.793	2.310
620.00	13.744	11.510	9.661	7.858	6.841	5.813	8.415	7.107	5.906	4.722	4.095	3.292	2.748
622.00	14.529	12.167	10.199	8.281	7.192	6.080	8.909	7.523	6.260	4.995	4.329	3.464	2.892
624.00	15.539	13.014	10.867	8.801	7.598	6.439	9.575	8.091	6.726	5.340	4.619	3.680	3.071
626.00	16.791	14.053	11.688	9.441	8.109	6.808	10.439	8.817	7.306	5.769	4.973	3.942	3.288
628.00	18.243	15.262	12.649	10.193	8.709	7.272	11.493	9.[illegible]	7.995	6.282	5.392	4.251	3.526
630.00	19.849	16.628	13.757	11.070	9.415	7.820	12.717	10.703	8.804	6.998	5.897	4.619	3.813
632.00	21.573	18.130	15.008	12.079	10.233	8.455	14.059	11.850	9.738	7.598	6.462	5.047	4.147
634.00	23.375	19.746	16.399	13.201	11.144	9.161	15.591	13.127	10.791	8.405	7.109	5.532	4.524
636.00	25.223	21.420	17.848	14.407	12.131	9.930	17.160	14.494	11.929	9.292	7.825	6.067	4.944
638.00	27.117	23.175	19.378	15.700	13.206	10.776	18.816	15.938	13.149	10.252	8.613	6.659	5.409
640.00	29.052	24.991	20.988	17.064	14.340	11.676	20.555	17.472	14.445	11.281	9.454	7.299	5.913
642.00	31.003	26.821	22.613	18.436	15.425	12.590	22.341	19.044	15.769	12.330	10.302	7.951	6.426
644.00	32.963	28.674	24.263	19.842	16.676	13.533	24.166	20.648	17.124	13.412	11.194	8.638	6.974
646.00	34.946	30.555	25.954	21.292	17.913	14.534	26.033	22.304	18.525	14.545	12.139	9.375	7.557
648.00	36.937	32.475	27.728	22.869	19.293	15.690	27.946	24.044	20.055	15.817	13.271	10.268	8.296
650.00	38.936	34.456	29.660	24.701	20.952	17.204	29.919	25.946	21.847	17.425	14.743	11.535	9.377
652.00	40.936	36.438	31.579	26.482	22.605	18.590	31.894	27.843	23.591	18.966	16.059	12.641	10.291
654.00	42.936	38.417	33.482	28.236	24.175	19.914	33.866	29.713	25.285	20.418	17.305	13.653	11.103
656.00	44.936	40.400	35.336	29.976	25.716	21.190	35.840	31.591	26.985	21.869	18.527	14.622	11.867
658.00	46.936	42.380	37.290	31.715	27.252	22.459	37.814	33.478	28.695	23.321	19.748	15.581	12.626

660.00	48.936	44.361	39.190	33.445	28.770	23.707	39.789	35.364	30.402	24.763	20.947	16.518	13.367
662.00	50.936	46.340	41.081	35.162	30.270	24.939	41.756	37.235	32.088	26.179	22.132	17.443	14.104
664.00	52.936	48.320	42.998	36.944	31.966	26.366	43.720	39.112	33.817	27.702	23.496	18.555	15.070
666.00	54.936	50.305	44.911	38.728	33.520	27.749	45.681	40.972	35.502	29.163	24.738	19.629	15.939
668.00	56.936	52.301	46.849	40.553	35.218	29.223	47.662	42.885	37.286	30.718	26.170	20.873	16.981
670.00	58.936	54.301	48.845	42.534	37.180	31.137	49.662	44.880	39.266	32.658	28.077	22.721	18.716
672.00	60.936	56.380	50.829	44.461	39.003	32.804	51.662	46.860	41.132	34.460	29.693	24.119	19.978
674.00	62.936	58.295	52.768	46.266	40.624	34.191	53.652	48.785	42.957	36.014	31.014	25.182	20.837
676.00	64.936	60.284	54.692	48.043	42.215	35.528	55.636	50.696	44.712	37.533	32.313	26.222	21.660
678.00	66.936	62.272	56.618	49.820	43.808	36.873	57.626	52.613	46.470	39.055	33.614	27.259	22.494
680.00	68.936	64.260	58.541	51.595	45.383	38.201	59.616	54.531	48.222	40.562	34.900	28.293	23.305
682.00	70.936	66.249	60.463	53.338	46.937	39.505	61.607	56.443	49.963	42.048	36.160	29.303	24.114
684.00	72.936	68.233	62.374	55.068	48.455	40.764	63.597	58.349	51.679	43.493	37.376	30.271	24.896
686.00	74.936	70.215	64.266	56.767	49.928	41.969	65.581	60.234	53.360	44.890	38.530	31.185	25.639
688.00	76.936	72.191	66.133	58.425	51.342	43.107	67.554	62.093	54.998	46.230	39.627	32.031	26.314
690.00	78.936	74.167	68.007	60.106	52.807	44.320	69.516	63.948	56.653	47.617	40.803	32.963	27.054
692.00	80.936	76.128	69.861	61.776	54.262	45.516	71.467	65.775	58.281	48.989	41.943	33.866	27.738
694.00	82.929	78.053	71.629	63.322	55.583	46.584	73.379	67.519	59.785	50.221	42.959	34.655	28.412
696.00	84.910	79.942	73.335	64.793	56.821	47.565	75.250	69.198	61.218	51.352	43.898	35.373	28.974
698.00	86.877	81.790	74.966	66.161	57.945	48.439	77.078	70.812	62.555	52.435	44.733	36.009	29.478
700.00	88.829	83.599	76.530	67.443	58.973	49.236	78.861	72.356	63.906	53.398	45.494	36.584	29.932
702.00	90.760	85.380	78.057	68.688	59.969	50.002	80.591	73.849	65.015	54.324	46.222	37.127	30.358
704.00	92.654	87.110	79.525	69.887	60.926	50.750	82.241	75.258	66.155	55.198	46.910	37.648	30.769
706.00	94.461	88.705	80.838	70.940	61.759	51.391	83.761	76.516	67.154	55.964	47.501	38.089	31.125
708.00	96.174	90.166	82.011	71.854	62.473	51.937	85.143	77.639	68.029	56.624	48.011	38.469	31.424
710.00	97.793	91.532	83.091	72.684	63.116	52.431	86.406	78.654	68.819	57.216	48.466	38.809	31.691
712.00	99.286	92.773	84.061	73.432	63.695	52.874	87.534	79.557	69.514	57.737	48.870	39.108	31.936
714.00	100.623	93.871	84.914	74.092	64.208	53.265	88.511	80.347	70.121	58.199	49.229	39.376	32.155
716.00	101.806	94.827	85.656	74.670	64.660	53.613	89.345	81.025	70.648	58.600	49.546	39.611	32.348
718.00	102.925	95.755	86.408	75.261	65.124	53.996	90.117	81.672	71.168	58.995	49.885	39.868	32.549
720.00	104.418	97.150	87.666	76.314	66.018	54.801	91.322	82.763	72.157	59.790	50.642	40.456	32.934
722.00	106.068	98.717	89.117	77.684	67.257	55.553	92.805	84.169	73.436	60.951	51.649	41.335	33.728
724.00	106.915	99.435	89.716	78.241	67.723	56.208	93.410	84.704	73.890	61.358	51.960	41.613	33.995
726.00	107.518	99.926	90.108	78.554	67.968	56.409	93.779	85.013	74.139	61.554	52.125	41.742	34.100
728.00	108.179	100.468	90.531	78.886	68.236	56.628	94.216	85.374	74.422	61.769	52.304	41.881	34.211
730.00	108.912	101.052	90.951	79.237	68.515	56.854	94.708	85.775	74.729	62.000	52.493	42.027	34.321
732.00	109.686	101.659	91.447	79.598	68.797	57.074	95.239	86.197	75.048	62.239	52.686	42.174	34.430
734.00	110.473	102.269	91.912	79.956	69.078	57.289	95.736	86.627	75.371	62.480	52.877	42.322	34.542
736.00	111.259	102.871	92.366	80.297	69.355	57.500	96.331	87.056	75.688	62.718	53.064	42.468	34.656
738.00	112.040	103.475	92.821	80.647	69.638	57.720	96.870	87.480	76.004	62.952	53.255	42.616	34.772
740.00	112.844	104.121	93.320	81.049	69.972	57.986	97.424	87.922	76.350	63.212	53.477	42.794	34.914
742.00	113.819	104.959	94.032	81.656	70.498	58.414	98.113	88.500	76.849	63.613	53.844	43.105	35.152
744.00	114.736	105.706	94.630	82.171	70.925	58.765	98.747	89.047	77.271	63.981	54.138	43.348	35.365
746.00	115.333	106.158	94.957	82.419	71.114	58.914	99.144	89.371	77.503	64.160	54.267	43.454	35.447
748.00	115.851	106.553	95.253	82.635	71.286	59.054	99.455	89.656	77.712	64.311	54.386	43.550	35.520
750.00	116.304	106.925	95.526	82.841	71.451	59.195	99.781	89.986	77.899	64.451	54.494	43.643	35.594
752.00	116.697	107.258	95.773	83.034	71.611	59.333							
754.00	117.027	107.550	95.999	83.214	71.760	59.471							
756.00	117.304	107.803	96.209	83.383	71.902	59.611							
758.00	117.548	108.033	96.404	83.557	72.052	59.755							
760.00	117.735	108.211	96.559	83.699	72.166	59.865							
762.00	117.871	108.345	96.672	83.805	72.254	59.956							
764.00	117.979	108.455	96.761	83.899	72.336	60.037							
766.00	118.055	108.549	96.837	83.972	72.411	60.109							
768.00	118.121	108.627	96.902	84.034	72.474	60.178							
770.00	118.159	108.690	96.959	84.082	72.523	60.245							
772.00	118.187	108.743	97.003	84.125	72.563	60.309							
774.00	118.205	108.789	97.043	84.164	72.597	60.367							
776.00	118.211	108.825	97.065	84.199	72.625	60.417							
778.00	118.211	108.867	97.081	84.233	72.655	60.464							
780.00	118.211	108.901	97.098	84.253	72.682	60.512							

* The units of u are molecules/cm^2, abbreviated here by (#/cm^2)

TABLE 14 $\int_{\nu_0}^{\nu} A\, d\nu$

Sam. No.	HH01	HH02	HH03	HH04	HH05	HH06	HH07	HH08	H101	H102	H103	H104	H105	H106	H107	H108	H109
Temp (K)	310.	310.	310.	310.	310.	310.	310.	310.	310.	310.	310.	310.	310.	310.	310.	310.	310.
Path (cm)	1648.	1648.	1648.	1648.	1648.	3291.	3291.	3291.	1648.	1648.	1648.	1648.	1648.	1648.	3291.	3291.	3291.
Conc.	0.00250	0.00503	0.00977	0.01910	0.03850	0.03850	0.08090	0.15300	0.00125	0.00250	0.00503	0.00977	0.01910	0.03850	0.03850	0.08090	0.15300
P (atm)	1.000000	0.500000	0.248684	0.124342	0.061842	0.030921	0.015263	0.007500	1.000000	0.500000	0.250000	0.125000	0.062105	0.030921	0.015395	0.007632	0.003684
P_e (atm)	1.000750	0.500754	0.249413	0.125055	0.062556	0.031278	0.015634	0.007844	1.000375	0.500375	0.250377	0.125366	0.062461	0.031278	0.015573	0.007817	0.003853
u (#/cm²)*	9.740E 19	9.819E 19	9.485E 19	9.272E 19	9.295E 19	9.281E 19	9.627E 19	8.946E 19	4.880E 19	4.880E 19	4.909E 19	4.768E 19	4.631E 19	4.648E 19	4.621E 19	4.813E 19	4.395E 19
ν (cm^{-1})																	
590.00	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
592.00	0.139	0.129	0.116	0.092	0.069	0.056	0.046	0.033	0.077	0.070	0.066	0.073	0.041	0.031	0.015	0.025	0.010
594.00	0.360	0.278	0.244	0.139	0.140	0.127	0.091	0.066	0.163	0.145	0.136	0.161	0.085	0.066	0.038	0.050	0.022
596.00	0.567	0.465	0.417	0.319	0.235	0.205	0.155	0.119	0.279	0.250	0.275	0.261	0.149	0.106	0.075	0.078	0.045
598.00	0.933	0.525	0.722	0.591	0.456	0.395	0.339	0.246	0.535	0.459	0.410	0.435	0.259	0.219	0.165	0.156	0.116
600.00	1.135	1.077	1.320	0.735	0.577	0.490	[illegible]	0.311	0.674	0.604	0.537	0.559	0.365	0.277	0.215	0.195	0.151
602.00	1.454	1.297	1.397	0.465	0.672	0.572	[illegible]	0.367	0.929	0.739	0.652	0.665	0.432	0.320	0.257	0.222	0.179
604.00	1.743	1.533	1.295	1.019	0.777	0.661	[illegible]	0.422	0.997	0.881	0.774	0.773	0.506	0.372	0.301	0.247	0.211
606.00	2.045	1.782	1.455	1.166	0.933	0.756	0.566	0.475	1.173	1.030	0.597	0.935	0.599	0.431	0.355	0.292	0.244
608.00	2.359	2.043	1.695	1.329	1.002	0.956	0.639	0.531	1.356	1.147	1.020	1.062	0.664	0.469	0.391	0.319	0.254
610.00	2.670	2.310	1.937	1.459	1.129	0.962	0.717	0.592	1.540	1.349	1.166	1.127	0.752	0.557	0.434	0.366	0.319
612.00	2.964	2.565	2.112	1.661	1.250	1.061	0.796	0.645	1.704	1.453	1.290	1.237	0.832	0.613	0.493	0.403	0.351
614.00	3.242	2.912	2.320	1.875	1.371	1.169	0.966	0.712	1.862	1.634	1.416	1.354	0.915	0.676	0.539	0.453	0.392
616.00	3.603	3.147	2.616	2.032	1.566	1.353	1.313	0.973	2.076	1.919	1.590	1.523	1.063	0.725	0.640	0.533	0.444
618.00	4.712	4.207	3.577	2.952	2.237	1.981	1.515	1.232	2.917	2.593	2.314	2.157	1.649	1.244	1.024	0.925	0.665
620.00	5.430	4.945	4.231	[illegible]	2.539	2.429	1.974	1.541	3.519	3.261	2.869	2.693	2.019	1.587	1.290	1.039	0.941
622.00	5.707	5.200	4.419	3.722	2.985	2.549	1.967	1.612	3.669	3.333	2.991	2.905	2.102	1.666	1.343	1.055	0.992
624.00	6.159	5.560	4.719	3.965	3.174	2.703	2.090	1.711	3.954	3.529	3.169	2.369	2.227	1.761	1.420	1.117	0.933
626.00	6.619	6.041	5.195	4.267	3.435	2.835	2.213	1.319	4.135	3.804	3.438	3.171	2.355	1.390	1.536	1.133	0.954
628.00	7.365	6.632	5.576	4.627	3.679	3.101	2.372	1.945	4.582	4.158	3.736	3.419	2.574	2.021	1.609	1.262	1.039
630.00	8.136	7.341	6.136	4.955	4.013	3.352	2.566	2.096	5.093	4.596	4.070	3.714	2.799	2.188	1.737	1.353	1.117
632.00	9.147	8.166	6.739	5.562	4.405	3.649	2.748	2.266	5.697	5.124	4.500	4.059	3.061	2.382	1.890	1.456	1.294
634.00	10.242	9.107	7.541	6.145	4.851	3.999	3.042	2.463	6.429	5.744	5.001	4.453	3.366	2.609	2.054	1.590	1.395
636.00	11.433	10.134	8.369	6.792	5.350	4.363	3.322	2.699	7.261	6.446	5.567	4.992	3.710	2.859	2.241	1.723	1.419
638.00	12.732	11.243	9.274	7.593	5.901	4.778	3.621	2.923	8.139	7.216	6.197	5.437	4.092	3.136	2.449	1.873	1.547
640.00	14.127	12.439	11.246	8.276	6.533	5.236	3.971	3.193	9.213	8.065	6.997	5.959	4.512	3.447	2.677	2.043	1.695
642.00	15.664	13.639	11.259	9.369	7.129	5.705	4.326	3.467	10.336	8.975	7.611	6.515	4.947	3.772	2.921	2.219	1.837
644.00	17.147	14.993	12.294	9.935	7.765	6.199	4.731	3.759	11.536	9.943	8.379	7.115	5.405	4.111	3.179	2.411	1.991
646.00	18.761	16.353	13.399	10.770	8.459	6.730	5.104	4.075	12.919	10.977	9.202	7.757	5.901	4.479	3.456	2.617	2.162
648.00	20.473	17.935	14.633	11.939	9.339	7.419	5.655	4.534	14.223	12.141	10.166	8.549	6.559	4.933	3.558	2.831	2.494
650.00	22.331	19.560	16.193	13.199	10.523	8.446	6.538	5.193	15.538	13.579	11.449	9.667	7.526	5.768	4.492	3.435	2.919
652.00	24.131	21.254	17.560	14.441	11.565	9.277	7.159	5.735	17.423	14.959	12.612	10.621	8.282	6.323	4.962	3.790	3.131
654.00	26.017	22.931	19.057	[illegible]	12.535	10.011	7.720	6.155	18.990	16.277	13.694	11.457	8.961	6.893	5.357	4.092	3.376
656.00	27.963	24.565	20.470	16.752	13.432	10.713	8.263	6.599	20.569	17.622	14.796	12.359	9.630	7.395	5.729	4.352	3.596
658.00	29.717	26.246	21.930	17.914	14.354	11.412	8.794	7.003	22.159	19.945	15.914	13.234	10.299	7.898	6.092	4.620	3.810

660.00	31.566	27.925	23.323	19.363	15.259	12.093	9.339	7.394	23.736	20.336	17.315	14.092	10.949	8.365	6.441	4.990	4.017
662.00	33.390	29.571	24.711	20.194	16.142	12.766	9.927	7.799	25.253	21.635	18.074	14.925	11.591	8.945	6.799	5.147	4.239
664.00	35.135	31.222	26.155	21.419	17.232	13.645	10.547	8.362	26.750	22.930	19.190	15.967	12.374	9.464	7.334	5.544	4.562
666.00	36.967	32.795	27.477	22.573	18.117	14.378	11.129	8.937	28.146	24.090	20.124	16.671	12.979	9.972	7.690	5.944	4.933
668.00	38.945	34.[illegible]09	28.893	23.911	19.240	15.370	12.049	9.630	29.814	25.559	21.367	17.792	13.974	10.756	8.449	6.565	5.452
670.00	40.839	36.493	30.931	25.647	21.357	17.109	13.677	11.120	31.793	27.493	23.245	19.515	15.693	12.397	9.911	7.352	6.614
672.00	42.903	38.353	32.720	27.313	22.471	18.301	14.619	11.307	33.636	29.231	24.677	20.875	16.805	13.324	10.650	7.991	7.133
674.00	44.695	40.146	34.241	28.575	23.502	19.054	15.223	12.172	35.301	30.631	26.048	21.935	17.549	13.890	11.071	8.689	7.366
676.00	46.537	41.831	35.736	29.915	24.530	19.955	15.931	12.919	36.969	32.123	27.236	22.779	18.279	14.434	11.472	8.981	7.686
678.00	48.459	43.630	37.241	31.067	25.536	20.625	16.350	13.249	38.656	33.595	28.450	23.736	19.016	14.943	11.974	9.275	7.845
680.00	50.393	45.373	38.737	32.310	26.595	21.350	16.963	13.692	40.349	35.045	29.658	24.690	19.752	15.534	12.279	9.573	8.095
682.00	52.290	47.105	40.216	33.525	27.454	22.145	17.542	14.137	42.025	36.494	30.845	25.627	20.475	16.078	12.622	9.969	8.347
684.00	54.176	48.815	41.652	34.703	28.424	22.873	18.097	14.504	43.655	37.990	31.992	26.527	21.171	16.604	13.073	10.156	8.590
686.00	56.043	50.496	43.041	35.913	29.311	23.559	18.616	14.977	45.394	39.250	33.030	27.376	21.816	17.059	13.444	10.430	8.913
688.00	57.930	52.128	44.377	36.971	30.134	24.183	19.094	15.359	46.970	40.554	34.109	28.165	22.414	17.548	13.793	10.682	9.024
690.00	59.793	53.750	45.733	37.969	31.013	24.866	19.637	15.767	48.407	41.842	35.152	28.990	23.071	18.050	14.156	10.867	9.266
692.00	61.431	55.331	47.053	39.052	31.893	25.545	20.145	16.172	49.877	43.032	36.156	29.797	23.692	18.525	14.523	11.273	9.494
694.00	63.174	56.801	48.256	40.317	32.643	26.119	20.569	16.504	51.242	44.216	37.069	30.496	24.214	18.924	14.816	11.433	9.673
696.00	64.799	58.263	49.395	41.004	33.332	26.635	20.950	16.796	52.522	45.276	37.919	31.153	24.696	19.251	15.066	11.617	9.826
698.00	66.345	59.520	50.436	41.713	33.950	27.095	21.259	17.062	53.797	46.249	38.637	31.739	25.129	19.559	15.315	11.752	9.969
700.00	67.909	60.749	51.390	42.441	34.507	27.513	21.597	17.307	54.791	47.133	39.330	32.269	25.515	19.985	15.531	11.931	10.099
702.00	69.133	61.911	52.294	43.125	35.025	27.957	21.892	17.529	55.774	47.941	40.019	32.756	25.871	20.146	15.725	12.163	10.219
704.00	70.443	62.943	53.129	43.761	35.510	28.256	22.156	17.746	56.647	48.665	40.596	33.202	26.197	20.392	15.910	12.191	10.341
706.00	71.555	63.926	53.956	44.318	35.933	28.576	22.392	17.939	57.405	49.297	41.098	33.591	26.492	20.605	16.071	12.296	10.449
708.00	72.551	64.747	54.[illegible]	44.799	36.296	28.941	22.591	18.101	58.059	49.835	41.525	33.926	26.726	20.790	16.209	12.396	10.536
710.00	73.473	65.475	55.040	45.223	36.616	29.091	22.709	18.253	58.603	50.302	41.899	34.223	26.939	20.954	16.331	12.469	10.620
712.00	74.174	66.109	55.522	45.637	36.892	29.290	22.932	18.394	59.070	50.659	42.220	34.492	27.129	21.093	16.437	12.545	10.703
714.00	74.905	66.647	55.941	45.923	37.134	29.473	23.077	18.517	59.441	51.027	42.495	34.709	27.292	21.223	16.525	12.612	10.777
716.00	75.325	67.101	56.308	46.199	37.344	29.635	23.205	18.627	59.739	51.294	42.726	34.985	27.434	21.331	16.601	12.676	10.844
718.00	75.735	67.521	56.650	46.469	37.554	29.812	23.349	18.740	60.009	51.538	42.945	35.192	27.595	21.445	16.692	12.745	10.916
720.00	76.633	68.327	57.395	47.079	38.046	30.216	23.705	19.192	60.613	52.656	43.475	35.544	28.010	21.745	16.943	12.961	11.064
722.00	77.913	69.535	58.500	47.345	38.592	30.911	24.255	19.451	61.619	53.061	44.372	36.331	28.632	22.257	17.342	13.237	11.314
724.00	78.363	69.929	58.955	47.871	39.191	31.142	24.415	19.612	61.921	53.362	44.621	36.591	28.782	22.409	17.450	13.315	11.439
726.00	78.555	70.111	59.011	48.499	39.293	31.225	24.495	19.675	62.033	53.457	44.711	36.667	28.847	22.466	17.499	13.351	11.447
728.00	79.312	70.330	59.197	48.641	39.407	31.319	24.563	19.739	62.176	53.576	44.925	36.769	28.919	22.527	17.530	13.386	11.497
730.00	79.101	70.575	59.435	48.795	39.529	31.415	24.639	19.803	62.344	53.719	44.953	36.897	28.999	22.590	17.576	13.421	11.524
732.00	79.423	70.950	59.621	48.957	39.653	31.513	24.716	19.865	62.534	53.879	45.091	36.999	29.083	22.654	17.625	13.457	11.556
734.00	79.751	71.137	59.943	49.126	39.776	31.610	24.793	19.929	62.736	54.049	45.236	37.115	29.165	22.718	17.675	13.493	11.591
736.00	80.106	71.426	60.062	49.299	39.897	31.704	24.870	19.998	62.945	54.226	45.392	37.240	29.250	22.793	17.724	13.529	11.614
738.00	80.453	71.712	60.293	49.450	40.021	31.799	24.945	20.049	63.157	54.402	45.530	37.361	29.333	22.849	17.772	13.569	11.646
740.00	80.991	72.010	60.517	49.626	40.151	31.912	25.056	20.155	63.371	54.591	45.694	37.459	29.429	22.922	17.831	13.613	11.657
742.00	81.225	72.396	60.843	49.797	40.334	32.107	25.225	20.256	63.639	54.905	45.890	37.679	29.579	23.056	17.942	13.719	11.769
744.00	81.615	72.7[illegible]3	61.136	50.147	40.603	32.281	25.362	20.375	63.857	55.006	46.076	37.849	29.705	23.161	18.029	13.750	11.844
746.00	81.951	72.951	61.392	50.277	40.697	32.354	25.426	20.422	63.999	55.119	46.179	37.937	29.770	23.216	18.065	13.803	11.876
748.00	82.046	73.120	61.441	50.396	40.772	32.423	25.497	20.467	64.112	55.206	46.265	38.023	29.826	23.261	18.106	13.826	11.899
750.00	82.220	73.265	61.573	50.431	40.942	32.436	25.542	20.496	64.214	55.232	46.346	38.109	29.874	23.302	18.142	13.851	11.922

* The units of u are molecules/cm^2, abbreviated here by (#/cm^2)

TABLE 15 $\int_0^{\nu} A \, d\nu$

Sam. No	MJ01	MJ02	MJ03	MJ04	MJ05
Temp (K)	310.	310.	310.	310.	310.
Path (cm)	826.	1648.	1648.	1648.	1648.
Conc	0.00125	0.00125	0.00250	0.00503	0.00977
P (atm)	1.000000	0.500000	0.250000	0.125000	0.062368
P_e (atm)	1.000325	0.500188	0.250188	0.125189	0.062551
u (#/cm²)*	2.446E 19	2.440E 19	2.440E 19	2.455E 19	2.379E 19
610.00	0.	0.	0.	0.	0.
612.00	0.095	0.074	0.098	0.064	0.040
614.00	0.154	0.244	0.161	0.133	0.057
616.00	0.237	0.239	0.270	0.227	0.166
618.00	0.493	0.765	0.510	0.707	0.546
620.00	1.333	1.223	1.213	1.033	0.531
622.00	1.419	1.255	1.251	1.147	0.931
624.00	1.536	1.351	1.397	1.261	1.036
626.00	1.631	1.526	1.531	1.363	1.190
628.00	1.966	1.715	1.721	1.515	1.215
630.00	2.195	1.962	1.953	1.695	1.359
632.00	2.517	2.269	2.227	1.915	1.576
634.00	2.975	2.645	2.555	2.165	1.723
636.00	3.523	3.297	2.928	2.454	1.943
638.00	4.139	3.591	3.350	2.736	2.201
640.00	4.935	4.152	3.415	3.152	2.435
642.00	5.533	4.759	4.320	3.533	2.736
644.00	6.453	5.459	4.563	3.955	3.039
646.00	7.399	6.261	5.454	4.421	3.443
648.00	9.470	7.360	6.168	4.973	3.991
650.00	9.753	8.182	7.152	5.311	4.619
652.00	11.045	9.193	8.020	6.594	5.153
654.00	12.225	10.132	8.925	7.113	5.692
656.00	13.461	11.183	9.844	7.737	6.155
658.00	14.707	12.197	10.459	8.351	6.615
660.00	15.923	13.133	11.274	8.965	7.079
662.00	17.035	14.129	12.337	[illegible]	7.524
664.00	18.197	14.644	12.977	10.159	8.763
666.00	19.175	15.574	13.466	10.655	8.471
668.00	20.543	17.419	14.426	11.559	9.237
670.00	22.454	18.679	16.192	13.262	10.326
672.00	24.067	20.355	17.533	14.356	11.755
674.00	25.192	21.492	18.454	15.045	12.232
676.00	26.715	22.541	19.358	15.729	12.914
678.00	28.032	23.676	20.269	16.427	13.344
680.00	29.452	24.393	21.196	17.125	13.926
682.00	31.013	25.317	22.135	17.913	14.493
684.00	32.139	26.997	22.357	18.422	14.915
686.00	33.423	28.324	23.779	19.297	15.393
688.00	34.653	29.993	24.540	19.664	15.573
690.00	35.425	29.559	25.315	20.255	16.299
692.00	35.941	30.475	26.015	20.515	16.726
694.00	37.957	31.651	25.435	21.312	17.132
696.00	39.833	32.399	27.131	21.765	17.469
698.00	39.721	33.845	27.544	22.163	17.743
700.00	40.477	33.610	28.127	22.534	18.421
702.00	41.131	34.185	28.756	22.950	18.267
704.00	41.135	34.545	29.142	23.143	18.631
706.00	42.165	35.544	29.476	23.432	18.656
708.00	42.454	35.	29.761	23.619	18.954
710.00	42.477	35.656	31.037	23.914	19.048
712.00	43.125	35.935	31.215	23.979	19.132
714.00	43.325	36.263	31.339	24.113	19.241
716.00	43.473	36.215	31.574	24.237	19.337
718.00	43.625	36.345	31.667	24.346	19.426
720.00	44.037	36.717	31.912	24.549	19.619
722.00	44.263	37.427	31.736	25.265	20.139
724.00	44.967	37.626	31.316	25.427	20.325
726.00	45.321	37.676	31.971	25.476	20.376
728.00	45.091	37.739	32.046	25.532	20.427
730.00	45.175	37.419	32.130	25.631	20.473
732.00	45.277	37.913	32.220	25.676	20.574
734.00	45.374	38.339	32.316	25.756	20.594
[illegible]	45.434	39.059	32.365	25.736	20.623

Sam. No	MJ06	MJ07	MJ08	MJ09	MJ10
Temp (K)	310.	310.	310.	310.	310.
Path (cm)	1648.	1648.	3291.	3291.	3291.
Conc	0.01910	0.03850	0.03850	0.08090	0.15300
P (atm)	0.031053	0.015395	0.007763	0.003816	0.001895
P_e (atm)	0.031231	0.015573	0.007853	0.003908	0.001982
u (#/cm²)*	2.315E 19	2.314E 19	2.330E 19	2.407E 19	2.260E 19
610.00	0.	0.	0.	0.	0.
612.00	0.042	0.024	0.032	0.019	0.017
614.00	0.055	0.063	0.071	0.345	0.332
616.00	0.153	0.115	0.127	0.263	0.265
618.00	0.450	0.376	0.326	0.245	0.193
620.00	0.737	0.572	0.473	0.349	0.264
622.00	0.734	0.612	0.507	0.373	0.279
624.00	0.858	0.666	0.552	0.395	0.393
626.00	0.932	0.722	0.604	0.426	0.333
628.00	1.029	0.751	0.662	0.462	0.364
630.00	1.141	0.874	0.729	0.505	0.474
632.00	1.276	0.967	0.936	0.551	0.469
634.00	1.423	1.077	0.992	0.629	0.595
636.00	1.638	1.203	0.993	0.676	0.566
638.00	1.731	1.379	1.104	0.746	0.624
640.00	2.092	1.492	1.225	0.925	0.696
642.00	2.235	1.656	1.353	0.909	0.754
644.00	2.456	1.825	1.457	1.323	0.931
646.00	2.723	2.011	1.632	1.193	0.315
648.00	3.056	2.300	1.551	1.263	1.047
650.00	3.675	2.761	2.213	1.547	1.299
652.00	4.125	3.091	2.474	1.732	1.457
654.00	4.453	3.357	2.691	1.972	1.594
656.00	4.932	3.613	2.979	2.003	1.739
658.00	5.193	3.849	3.074	2.137	1.916
660.00	5.515	4.113	3.283	2.265	1.974
662.00	5.943	4.362	3.456	2.437	2.034
664.00	6.292	4.712	3.716	2.619	2.210
666.00	6.634	4.971	3.957	2.727	2.357
668.00	7.273	5.605	4.546	3.347	2.752
670.00	8.712	6.393	5.670	4.263	3.515
672.00	9.453	7.441	6.101	4.359	3.356
674.00	9.957	7.741	6.330	4.715	3.995
676.00	10.233	8.020	6.541	4.957	4.120
678.00	10.626	8.301	6.753	5.332	4.245
680.00	11.016	8.527	6.970	5.151	4.373
682.00	11.405	8.973	7.137	5.303	4.497
684.00	11.754	9.243	7.298	5.446	4.629
686.00	12.139	9.413	7.595	5.537	4.737
688.00	12.463	9.659	7.771	5.714	4.359
690.00	12.616	9.933	7.974	5.943	4.933
692.00	13.131	10.116	8.153	5.934	5.095
694.00	13.423	10.356	8.337	6.101	5.131
696.00	13.650	10.566	8.442	6.193	5.277
698.00	13.905	10.729	8.564	6.275	5.345
700.00	14.196	10.876	8.675	6.343	5.414
702.00	14.253	11.020	8.776	6.413	5.491
704.00	14.457	11.135	8.873	6.469	5.359
706.00	14.636	11.243	8.960	6.522	5.607
708.00	14.732	11.344	9.032	6.567	5.652
710.00	14.944	11.426	9.035	6.401	5.695
712.00	14.924	11.484	9.154	6.637	5.739
714.00	15.029	11.560	9.216	6.662	5.779
716.00	15.133	11.615	9.256	6.697	5.911
718.00	15.176	11.676	9.396	6.724	5.951
720.00	15.351	11.939	9.426	6.812	5.073
722.00	15.764	12.123	9.644	6.973	6.355
724.00	15.631	12.222	9.714	7.013	6.112
726.00	15.915	12.255	9.739	7.042	6.131
728.00	15.954	12.266	9.764	7.063	6.149
730.00	15.935	12.321	9.796	7.091	6.175
732.00	16.037	12.355	9.814	7.115	6.196
734.00	16.032	12.395	9.869	7.137	6.219
[illegible]	16.131	12.414	9.946	7.147	6.231

Sam. No	HK01	HK02	HK03	HK04
Temp (K)	310.	310.	310.	310.
Path (cm)	826.	1648.	1648.	1648.
Conc	0.00125	0.00125	0.00250	0.00503
P (atm)	0.500000	0.250000	0.125000	0.062500
P_e (atm)	0.500188	0.250094	0.125094	0.062594
u (#/cm²)*	1.223E 19	1.220E 19	1.220E 19	1.227E 19
610.00	0.	0.	0.	0.
612.00	0.039	0.024	0.031	0.039
614.00	0.073	0.065	0.064	0.067
616.00	0.123	0.115	0.113	0.115
618.00	0.463	0.445	0.416	0.377
620.00	0.735	0.750	0.657	0.629
622.00	0.917	0.733	0.717	0.661
624.00	0.965	0.833	0.765	0.795
626.00	0.948	0.936	0.932	0.764
628.00	1.045	1.083	0.922	0.942
630.00	1.191	1.128	1.034	0.929
632.00	1.355	1.297	1.165	1.031
634.00	1.572	1.475	1.325	1.155
636.00	1.840	1.701	1.512	1.384
638.00	2.153	1.963	1.720	1.469
640.00	2.516	2.262	1.955	1.656
642.00	2.925	2.595	2.212	1.962
644.00	3.331	2.946	2.490	2.377
646.00	3.996	3.340	2.736	2.309
648.00	4.523	3.931	3.192	2.623
650.00	5.323	4.512	3.752	3.126
652.00	6.054	5.099	4.257	3.522
654.00	6.745	5.643	4.690	3.949
656.00	7.401	6.153	5.107	4.173
658.00	9.173	6.746	5.537	4.495
660.00	9.005	7.250	5.951	4.816
662.00	9.536	7.779	6.345	5.119
664.00	10.129	9.235	6.769	5.472
666.00	10.625	9.672	7.033	5.726
668.00	11.549	9.527	7.932	6.350
670.00	13.339	11.153	9.345	7.779
672.00	14.473	12.197	10.235	9.500
674.00	15.240	12.751	10.710	9.964
676.00	15.026	13.406	11.197	9.219
678.00	16.343	14.342	11.670	9.553
680.00	17.659	14.475	12.160	9.949
682.00	18.470	15.310	12.645	10.313
684.00	19.257	15.923	13.117	10.667
686.00	19.939	16.455	13.569	11.030
688.00	20.695	17.023	13.950	11.402
690.00	21.356	17.540	14.364	11.616
692.00	21.993	18.632	14.750	11.915
694.00	22.549	18.471	15.030	12.174
696.00	23.055	18.984	15.395	12.495
698.00	23.533	19.211	15.609	12.609
700.00	23.894	19.521	15.911	12.792
702.00	24.234	19.754	16.127	12.956
704.00	24.522	20.634	16.319	13.102
706.00	24.763	20.230	16.495	13.229
708.00	24.961	20.418	16.674	13.336
710.00	25.129	20.551	16.739	13.426
712.00	25.245	20.669	16.917	13.504
714.00	25.347	20.765	16.319	13.569
716.00	25.425	20.841	16.997	13.624
718.00	25.437	20.910	17.038	13.650
720.00	25.726	21.124	17.274	13.945
722.00	26.231	21.500	17.615	14.197
724.00	26.333	21.712	17.799	14.391
726.00	26.556	21.743	17.918	14.322
728.00	26.335	21.775	17.552	14.343
730.00	26.429	21.516	17.893	14.391
732.00	26.465	21.565	17.943	14.414
734.00	26.515	21.317	17.931	14.453
[illegible]	26.541	21.345	19.316	14.473

Sam. No	HK05	HK06	HK07	HK08	HK09
Temp (K)	310.	310.	310.	310.	310.
Path (cm)	1648.	1648.	1648.	3291.	3291.
Conc	0.00977	0.01910	0.03850	0.03850	0.08090
P (atm)	0.031184	0.015526	0.007763	0.003882	0.001921
P_e (atm)	0.031276	0.015615	0.007853	0.003926	0.001966
u (#/cm²)*	1.189E 19	1.158E 19	1.167E 19	1.165E 19	1.212E 19
610.00	0.	0.	0.	0.	0.
612.00	0.016	0.021	0.012	0.330	0.091
614.00	0.034	0.046	0.030	0.314	0.011
616.00	0.064	0.099	0.074	0.339	0.036
618.00	0.274	0.260	0.291	0.132	0.119
620.00	0.456	0.403	0.312	0.204	0.155
622.00	0.473	0.429	0.331	0.219	0.170
624.00	0.504	0.462	0.353	0.239	0.199
626.00	0.545	0.504	0.391	0.255	0.298
628.00	0.596	0.554	0.416	0.275	0.225
630.00	0.665	0.615	0.457	0.333	0.256
632.00	0.743	0.679	0.499	0.339	0.296
634.00	0.836	0.759	0.553	0.379	0.331
636.00	0.944	0.947	0.617	0.425	0.379
638.00	1.065	0.947	0.687	0.475	0.433
640.00	1.231	1.057	0.765	0.532	0.445
642.00	1.350	1.175	0.851	0.590	0.457
644.00	1.536	1.299	0.940	0.650	0.540
646.00	1.674	1.429	1.033	0.723	0.595
648.00	1.919	1.629	1.191	0.935	0.691
650.00	2.326	1.963	1.452	1.035	0.975
652.00	2.627	2.203	1.629	1.172	0.920
654.00	2.965	2.390	1.765	1.279	0.995
656.00	3.102	2.567	1.997	1.390	1.059
658.00	3.335	2.746	2.025	1.479	1.123
660.00	3.565	2.919	2.158	1.575	1.191
662.00	3.791	3.096	2.299	1.651	1.251
664.00	4.073	3.338	2.472	1.937	1.371
666.00	4.273	3.501	2.610	1.953	1.460
668.00	4.957	4.063	3.095	2.397	1.874
670.00	6.134	5.172	4.039	3.151	2.445
672.00	6.636	5.597	4.353	3.395	2.599
674.00	6.956	5.759	4.566	3.503	2.681
676.00	7.215	5.996	4.645	3.617	2.753
678.00	7.479	6.197	4.756	3.724	2.926
680.00	7.745	6.404	4.930	3.937	2.903
682.00	9.013	6.603	5.070	3.949	2.972
684.00	9.275	6.802	5.236	4.055	3.842
686.00	8.523	6.952	5.341	4.157	3.116
688.00	8.745	7.166	5.465	4.245	3.245
690.00	8.900	7.359	5.625	4.354	3.267
692.00	9.217	7.535	5.732	4.453	3.327
694.00	9.426	7.675	5.835	4.531	3.375
696.00	9.574	7.907	5.927	4.601	3.420
698.00	9.723	7.922	6.012	4.564	3.463
700.00	9.957	9.029	6.049	4.724	3.525
702.00	9.993	9.125	6.161	4.764	3.539
704.00	10.093	9.229	6.226	4.914	3.577
706.00	10.194	9.300	6.257	4.655	3.623
708.00	10.284	9.367	6.339	4.590	3.654
710.00	10.363	9.427	6.393	4.921	3.659
712.00	10.426	9.480	6.424	4.951	3.693
714.00	10.479	9.526	6.465	4.992	3.707
716.00	10.521	9.569	6.503	5.033	3.722
718.00	10.563	9.610	6.542	5.043	3.746
720.00	10.692	9.729	6.634	5.117	3.994
722.00	10.969	9.934	6.737	5.213	3.899
724.00	11.042	9.800	6.540	5.269	3.932
726.00	11.064	9.026	6.962	5.265	3.946
728.00	11.096	9.053	6.347	5.272	3.959
730.00	11.111	9.073	6.910	5.291	3.971
732.00	11.139	9.106	6.932	5.307	3.979
734.00	11.165	9.136	6.954	5.322	3.959
[illegible]	11.153	9.153	6.967	5.399	3.999

* The units of u are molecules/cm², abbreviated here by (#/cm²)

TABLE 16 $\int_{\nu'}^{\nu} A\,d\nu$

Sam. No.	HL01	HL02	HL03	HL04	HL05	HL06	HL07	HL08	HM01	HM02	HM03	HM04	HM05	HH01	HH02	HH03
Temp (K)	310.	310.	310.	310.	310.	310.	310.	310.	310.	310.	310.	310.	310.	310.	310.	310.
Path (cm)	826.	1648.	1648.	1648.	1648.	1648.	1648.	3291.	826.	1648.	1648.	1648.	1648.	826.	1648.	1648.
Conc.	0.00125	0.00125	0.00250	0.00503	0.00977	0.01910	0.03850	0.03850	0.00125	0.00125	0.00250	0.00503	0.00977	0.00125	0.00125	0.00977
P (atm)	0.250000	0.125000	0.062500	0.031316	0.015526	0.007761	0.003816	0.001921	0.125000	0.062500	0.031316	0.015658	0.007763	0.061842	0.031316	0.015586
P_e (atm)	0.250094	0.125047	0.062547	0.031363	0.015572	0.007808	0.003860	0.001943	0.125047	0.062523	0.031339	0.015682	0.007786	0.061865	0.031328	0.015538
u (#/cm²)*	6.115E 18	6.100E 18	6.100E 18	6.150E 18	5.922E 18	5.789E 18	5.735E 18	5.766E 18	3.057E 18	3.050E 18	3.056E 18	3.075E 18	2.961E 18	1.513E 18	1.528E 18	5.988E 18
ν (cm^{-1})																
610.00	0.	0.	0.	0.	0.	0.	0.	0.								
612.00	0.024	0.028	0.022	0.015	0.	0.009	0.008	0.								
614.00	0.050	0.046	0.044	0.037	0.	0.019	0.018	0.030								
616.	0.083	0.092	0.078	0.063	0.009	0.039	0.036	0.089								
618.00	0.291	0.277	0.255	0.205	0.103	0.119	0.104	0.064								
620.00	0.476	0.449	0.412	0.326	0.204	0.193	0.168	0.105								
622.00	0.495	0.465	0.426	0.347	0.215	0.206	0.179	0.121								
624.	0.523	0.491	0.449	0.367	0.226	0.223	0.198	0.135								
626.00	0.563	0.527	0.498	0.401	0.245	0.249	0.202	0.149								
628.00	0.612	0.573	0.526	0.442	0.269	0.271	0.219	0.165								
630.00	0.691	0.632	0.598	0.485	0.300	0.299	0.236	0.197								
632.	0.770	0.707	0.668	0.535	0.316	0.333	0.255	0.206								
634.00	0.931	0.800	0.742	0.595	0.351	0.372	0.279	0.235								
636.00	1.014	0.914	0.839	0.675	0.431	0.417	0.306	0.263								
638.00	1.177	1.043	0.947	0.759	0.496	0.465	0.339	0.291								
640.	1.369	1.193	1.069	0.950	0.547	0.514	0.374	0.321								
642.00	1.596	1.358	1.205	0.951	0.617	0.573	0.415	0.359								
644.00	1.922	1.541	1.352	1.060	0.693	0.634	0.461	0.394								
646.00	2.099	1.747	1.515	1.177	0.777	0.694	0.510	0.423								
648.00	2.417	2.013	1.730	1.355	0.903	0.792	0.594	0.495								
650.00	2.973	2.404	2.079	1.634	1.123	0.995	0.742	0.594								
652.00	3.275	2.725	2.341	1.936	1.279	1.108	0.838	0.670								
654.00	3.643	3.014	2.564	2.004	1.398	1.199	0.908	0.730								
656.05	4.023	3.300	2.784	2.171	1.514	1.285	0.972	0.777	0.	0.	0.	0.	0.	0.	0.	0.
658.00	4.401	3.580	3.008	2.340	1.631	1.371	1.039	0.922	0.193	0.147	0.102	0.082	0.069	0.098	0.075	0.125
660.00	4.764	3.884	3.226	2.587	1.745	1.457	1.104	0.570	0.377	0.289	0.288	0.167	0.114	0.190	0.140	0.243
662.00	5.102	4.123	3.432	2.668	1.855	1.545	1.169	0.922	0.552	0.421	0.294	0.249	0.166	0.273	0.216	0.350
664.00	5.435	4.391	3.657	2.856	1.999	1.668	1.266	1.005	0.724	0.562	0.402	0.344	0.238	0.360	0.208	0.582
666.00	5.603	4.592	3.923	2.992	2.105	1.761	1.337	1.069	0.859	0.667	0.488	0.414	0.290	0.424	0.347	0.699
668.00	6.396	5.267	4.399	3.550	2.529	2.158	1.672	1.341	1.403	1.174	0.945	0.837	0.619	0.864	0.769	1.105
670.	7.973	6.632	5.676	4.627	3.462	2.912	2.279	1.796	2.612	2.204	1.926	1.569	1.209	1.650	1.431	2.018
672.00	8.647	7.211	6.154	5.084	3.782	3.133	2.447	1.912	2.990	2.539	2.093	1.765	1.366	1.902	1.599	2.292
674.00	9.012	7.525	6.403	5.197	3.919	3.236	2.525	1.972	3.202	2.781	2.234	1.863	1.476	2.088	1.694	2.431
676.00	9.430	7.846	6.649	5.374	4.046	3.335	2.595	2.025	3.419	2.864	2.322	1.957	1.500	2.116	1.772	2.561
678.00	9.865	8.179	6.903	5.562	4.178	3.426	2.665	2.091	3.643	3.034	2.445	2.055	1.566	2.229	1.864	2.697
680.00	10.307	8.515	7.160	5.751	4.311	3.548	2.739	2.139	3.871	3.284	2.570	2.154	1.634	2.343	1.956	2.832
682.00	10.746	8.958	7.416	5.939	4.443	3.643	2.809	2.191								
684.00	11.172	9.175	7.666	6.123	4.574	3.742	2.876	2.240								
686.00	11.576	9.403	7.905	6.299	4.699	3.836	2.944	2.284								
688.00	11.940	9.764	8.123	6.460	4.816	3.925	3.011	2.329								
690.00	12.297	10.042	8.344	6.629	4.941	4.023	3.090	2.397								
692.00	12.632	10.304	8.551	6.791	5.056	4.113	3.159	2.441								
694.00	12.931	10.535	8.733	6.913	5.150	4.185	3.213	2.482								
696.00	13.194	10.739	8.894	7.032	5.236	4.248	3.261	2.519								
698.00	13.427	10.920	9.035	7.140	5.312	4.304	3.305	2.552								
700.00	13.632	11.001	9.161	7.236	5.379	4.355	3.341	2.592								
702.00	13.804	11.219	9.271	7.322	5.435	4.400	3.376	2.612								
704.00	13.952	11.341	9.369	7.401	5.491	4.445	3.410	2.644								
706.00	14.079	11.445	9.455	7.471	5.542	4.483	3.442	2.673								
708.00	14.141	11.531	9.526	7.530	5.595	4.516	3.469	2.700								
710.00	14.266	11.603	9.597	7.579	5.613	4.545	3.491	2.723								
712.00	14.332	11.661	9.641	7.623	5.641	4.573	3.510	2.747								
714.00	14.394	11.709	9.697	7.660	5.663	4.608	3.527	2.770								
716.00	14.426	11.749	9.726	7.693	5.693	4.626	3.545	2.793								
718.	14.469	11.786	9.766	7.727	5.795	4.652	3.570	2.820								
720.00	14.662	11.918	9.995	7.933	5.779	4.713	3.625	2.869								
722.00	14.938	12.165	10.120	8.013	5.919	4.820	3.717	2.941								
724.00	14.964	12.233	10.193	8.057	5.962	4.857	3.747	2.963								
726.	14.981	12.248	10.211	8.069	5.963	4.870	3.760	2.963								
728.00	15.001	12.269	10.234	8.094	5.963	4.896	3.774	2.963								
730.00	15.027	12.295	10.261	8.103	5.963	4.902	3.769	2.963								
732.00	15.049	12.325	10.288	8.131	5.963	4.918	3.800	2.963								
734.00	15.077	12.358	10.321	8.155	5.963	4.932	3.812	2.963								
735.00	15.092	12.376	10.337	8.173	5.963	4.941	3.820	2.963								

* The units of u are molecules/cm^2, abbreviated here by (#/cm^2)

TABLE 17 $\int_{\nu'}^{\nu} A\,d\nu$

Sam. No.	HP01	HP02	HP03	HP04	HP05	HP06	HP07	HP08	HP09
Temp (K)	310.	310.	310.	310.	310.	310.	310.	310.	310.
Path (cm)	3291.	3291.	3291.	3291.	3291.	3291.	3291.	3291.	3291.
Conc.	1.00000	0.15300	1.00000	0.08090	0.15300	1.00000	0.08090	0.15300	1.00000
P (atm)	0.769737	0.955263	0.385526	0.976316	0.477632	0.192105	0.488158	0.238158	0.096053
P_e (atm)	1.000658	0.999110	0.501184	1.000011	0.499555	0.249737	0.500005	0.249089	0.124868
U (#/cm^2)*	6.001E 22	1.139E 22	3.006E 22	6.158E 21	5.697E 21	1.498E 22	3.079E 21	2.841E 21	7.488E 21
ν (cm^{-1})									
500.00	0.	0.	0.	0.	0.	0.	0.	0.	0.
502.00	0.037	0.024	0.024	0.007	0.006	0.006	0.	0.	0.005
504.00	0.107	0.052	0.064	0.025	0.012	0.034	0.	0.	0.023
506.00	0.138	0.075	0.080	0.040	0.014	0.035	0.000	0.	0.031
508.00	0.222	0.110	0.122	0.058	0.025	0.063	0.007	0.008	0.055
510.00	0.465	0.180	0.248	0.072	0.046	0.136	0.021	0.025	0.095
512.00	0.582	0.219	0.300	0.093	0.054	0.177	0.025	0.025	0.120
514.00	0.694	0.254	0.347	0.111	0.066	0.212	0.028	0.025	0.144
516.00	0.833	0.302	0.408	0.124	0.077	0.254	0.032	0.027	0.166
518.00	1.025	0.363	0.500	0.140	0.095	0.317	0.044	0.036	0.196
520.00	1.251	0.427	0.611	0.163	0.118	0.388	0.057	0.051	0.229
522.00	1.503	0.498	0.735	0.196	0.143	0.463	0.073	0.067	0.260
524.00	1.773	0.576	0.868	0.231	0.168	0.542	0.084	0.081	0.284
526.00	2.094	0.666	1.027	0.272	0.209	0.637	0.099	0.102	0.318
528.00	2.480	0.774	1.221	0.317	0.257	0.753	0.122	0.126	0.365
530.00	2.852	0.885	1.405	0.369	0.305	0.855	0.143	0.144	0.401
532.00	3.229	0.997	1.585	0.427	0.349	0.956	0.166	0.162	0.439
534.00	3.603	1.110	1.764	0.482	0.391	1.060	0.188	0.183	0.481
536.00	3.977	1.216	1.942	0.534	0.435	1.164	0.208	0.205	0.524
538.00	4.352	1.319	2.128	0.582	0.479	1.274	0.230	0.232	0.569
540.00	4.653	1.404	2.281	0.620	0.512	1.361	0.247	0.255	0.599
542.00	4.915	1.475	2.406	0.654	0.539	1.434	0.264	0.266	0.625
544.00	5.305	1.628	2.611	0.731	0.614	1.569	0.308	0.301	0.700
546.00	6.885	2.629	3.959	1.380	1.254	2.561	0.686	0.661	1.287
548.00	8.135	3.068	4.726	1.637	1.486	2.983	0.819	0.787	1.489
550.00	8.741	3.233	5.037	1.722	1.570	3.156	0.865	0.832	1.572
552.00	9.327	3.393	5.342	1.798	1.654	3.312	0.912	0.878	1.657
554.00	9.999	3.582	5.690	1.890	1.745	3.499	0.965	0.926	1.754
556.00	10.771	3.806	6.105	2.004	1.851	3.721	1.028	0.988	1.863
558.00	11.623	4.073	6.535	2.140	1.979	3.971	1.101	1.064	1.988
560.00	12.577	4.375	7.120	2.306	2.129	4.259	1.182	1.142	2.134

TABLE 18 $\int_{\nu'}^{\nu} A\,d\nu$

Sam. No.	HW01	HW02	HW03	HW04	HW05	HW06	HW07	HW08
Temp (K)	310.	310.	310.	310.	310.	310.	310.	310.
Path (cm)	3291.	3291.	3291.	3291.	3291.	3291.	3291.	3291.
Conc.	1.00000	0.15300	1.00000	0.08090	0.15300	1.00000	0.08090	0.15300
P (atm)	0.769737	0.955263	0.384211	0.976316	0.477632	0.192105	0.488158	0.239474
P_e (atm)	1.000658	0.999110	0.499474	1.000011	0.499555	0.249737	0.500005	0.250466
u (#/cm^2)*	6.001E 22	1.139E 22	2.995E 22	6.158E 21	5.697E 21	1.498E 22	3.079E 21	2.856E 21
ν (cm^{-1})								
780.00	0.	0.	0.	0.	0.	0.	0.	0.
782.00	1.206	0.407	0.657	0.218	0.202	0.357	0.112	0.102
784.00	2.270	0.752	1.276	0.402	0.370	0.653	0.209	0.194
786.00	3.184	1.032	1.765	0.554	0.507	0.897	0.289	0.255
788.00	3.951	1.247	2.158	0.676	0.612	1.089	0.355	0.317
790.00	4.624	1.435	2.507	0.790	0.711	1.276	0.424	0.378
792.00	5.633	1.975	3.284	1.192	1.073	1.830	0.750	0.675
794.00	7.166	2.926	4.473	1.892	1.740	2.666	1.214	1.102
796.00	8.239	3.376	5.124	2.168	2.009	3.003	1.377	1.237
798.00	8.970	3.595	5.492	2.297	2.130	3.190	1.448	1.302
800.00	9.690	3.826	5.857	2.433	2.253	3.382	1.513	1.370
802.00	10.443	4.079	6.241	2.582	2.385	3.584	1.589	1.447
804.00	11.215	4.357	6.638	2.741	2.524	3.793	1.672	1.531
806.00	11.988	4.638	7.032	2.903	2.665	4.004	1.754	1.614
808.00	12.740	4.918	7.417	3.067	2.803	4.210	1.836	1.699
810.00	13.466	5.183	7.783	3.218	2.930	4.408	1.914	1.788
812.00	14.160	5.434	8.133	3.355	3.048	4.588	1.992	1.865
814.00	14.804	5.662	8.453	3.486	3.152	4.756	2.062	1.936
816.00	15.395	5.866	8.741	3.595	3.246	4.910	2.129	1.994
818.00	15.920	6.039	9.000	3.691	3.332	5.046	2.187	2.046
820.00	16.381	6.191	9.226	3.765	3.405	5.167	2.238	2.095
822.00	16.777	6.319	9.422	3.827	3.464	5.271	2.283	2.133
824.00	17.105	6.420	9.582	3.882	3.515	5.353	2.321	2.168
826.00	17.379	6.502	9.712	3.929	3.555	5.424	2.344	2.200
828.00	17.672	6.590	9.863	3.978	3.601	5.510	2.370	2.230
830.00	18.081	6.707	10.089	4.040	3.663	5.632	2.408	2.272
832.00	18.416	6.815	10.267	4.083	3.709	5.722	2.437	2.307
834.00	18.590	6.870	10.352	4.118	3.742	5.765	2.458	2.337
836.00	18.719	6.915	10.416	4.158	3.776	5.798	2.471	2.367
838.00	18.832	6.947	10.464	4.188	3.796	5.823	2.487	2.388
840.00	18.934	6.983	10.512	4.213	3.823	5.850	2.508	2.405
842.00	19.029	7.019	10.552	4.233	3.854	5.876	2.525	2.432
844.00	19.117	7.050	10.593	4.253	3.884	5.901	2.542	2.456
846.00	19.207	7.082	10.638	4.276	3.914	5.924	2.566	2.484
848.00	19.300	7.120	10.686	4.302	3.946	5.954	2.593	2.510
850.00	19.389	7.160	10.731	4.325	3.978	5.981	2.619	2.537

* The units of u are molecules/cm^2, abbreviated here by (#/cm^2)

TABLE 19 $\int A\,d\nu$

Sam. No.	ZA01	ZB02	ZC01	ZC03	ZD02	ZD04	ZE01	ZE03	ZE05
Temp (K)	274.	274.	274.	274.	274.	274.	274.	274.	274.
Path (cm)	3291.	3291.	3291.	3291.	3291.	3291.	1648.	3291.	3291.
Conc.	0.15300	0.15300	0.03850	0.15300	0.03850	0.15300	0.01910	0.03850	0.15300
P (atm)	0.956579	0.477632	0.988158	0.239474	0.494737	0.119737	0.994737	0.247368	0.059737
P_e (atm)	1.000486	0.499555	0.999571	0.250466	0.500451	0.125233	1.000437	0.250226	0.062479
u ($\#/cm^2$)	1.291E 22	6.446E 21	3.356E 21	3.238E 21	1.680E 21	1.616E 21	8.392E 20	8.400E 20	8.062E 20
ν (cm^{-1})									
560.00	0.	0.	0.	0.	0.	0.	0.	0.	0.
562.00	0.177	0.097	0.031	0.053	0.025	0.005	0.	0.	0.
564.00	0.394	0.201	0.092	0.109	0.052	0.020	0.004	0.004	0.002
566.00	0.649	0.330	0.144	0.176	0.086	0.034	0.018	0.016	0.012
568.00	0.970	0.491	0.223	0.260	0.119	0.064	0.041	0.044	0.030
570.00	1.381	0.700	0.339	0.369	0.169	0.114	0.070	0.076	0.058
572.00	1.866	0.955	0.482	0.494	0.234	0.178	0.100	0.111	0.094
574.00	2.444	1.259	0.661	0.655	0.312	0.259	0.129	0.151	0.132
576.00	3.148	1.649	0.899	0.862	0.424	0.366	0.187	0.214	0.195
578.00	4.014	2.247	1.211	1.134	0.589	0.506	0.245	0.306	0.257
580.00	4.997	2.703	1.595	1.435	0.788	0.663	0.391	0.412	0.336
582.00	6.205	3.439	2.129	1.843	1.064	0.867	0.562	0.561	0.446
584.00	7.575	4.261	2.759	2.310	1.397	1.117	0.769	0.745	0.575
586.00	8.976	5.120	3.462	2.803	1.772	1.373	1.022	0.947	0.707
588.00	10.519	6.091	4.237	3.368	2.219	1.670	1.349	1.189	0.863
590.00	12.172	7.165	5.225	4.001	2.736	2.004	1.758	1.472	1.042
592.00	13.910	8.337	6.267	4.697	3.319	2.374	2.242	1.791	1.242
594.00	15.726	9.615	7.478	5.469	3.975	2.781	2.802	2.146	1.459
596.00	17.625	11.083	8.764	6.473	4.761	3.306	3.474	2.584	1.740
598.00	19.614	12.854	10.424	7.793	5.950	4.253	4.511	3.368	2.333
600.00	21.567	14.461	11.948	8.839	6.902	4.350	5.344	3.910	2.667
602.00	23.551	16.042	13.448	9.831	7.794	5.381	6.215	4.394	2.939
604.00	25.532	17.701	15.023	10.909	8.759	5.966	7.111	4.916	3.236
606.00	27.526	19.419	16.658	12.065	9.735	6.601	8.058	5.477	3.564
608.00	29.525	21.201	18.350	13.311	10.882	7.304	9.053	6.036	3.931
610.00	31.525	22.996	20.057	14.564	11.992	8.017	10.063	6.710	4.311
612.00	33.525	24.801	21.772	15.815	13.103	8.719	11.061	7.324	4.679
614.00	35.525	26.622	23.500	17.086	14.221	9.440	12.051	7.943	5.061
616.00	37.525	28.502	25.300	18.534	15.474	10.341	13.149	8.711	5.596
618.00	39.525	30.404	27.265	20.409	17.261	11.932	14.853	10.225	6.847
620.00	41.525	32.405	29.154	21.996	18.811	13.106	16.259	11.349	7.690
622.00	43.525	34.168	30.855	23.234	19.959	13.843	17.235	12.072	8.109
624.00	45.525	36.022	32.677	24.662	21.302	14.735	18.546	12.856	8.604
626.00	47.525	37.970	34.613	26.299	22.859	15.819	20.944	13.974	9.228
628.00	49.525	39.960	36.597	28.102	24.619	17.075	21.740	15.061	9.961
630.00	51.525	41.960	38.596	30.013	26.490	18.489	23.563	16.412	10.816
632.00	53.525	43.960	40.596	31.970	28.421	20.054	25.458	17.999	11.910
634.00	55.525	45.960	42.596	33.949	30.379	21.731	27.336	19.529	12.99[illegible]
636.00	57.525	47.960	44.596	35.949	32.357	23.473	29.359	21.224	14.134
638.00	59.525	49.960	46.596	37.939	34.346	25.787	31.340	22.896	15.445
640.00	61.525	51.960	48.596	39.939	36.345	27.159	33.339	24.438	16.840
642.00	63.525	53.960	50.596	41.939	38.345	29.039	35.339	26.701	18.204
644.00	65.525	55.960	52.596	43.939	40.345	30.953	37.339	28.595	19.753
646.00	67.525	57.960	54.596	45.939	42.345	32.895	39.339	30.525	21.302
648.00	69.525	59.960	56.596	47.939	44.345	34.854	41.339	32.476	22.927
650.00	71.525	61.960	58.596	49.939	46.345	36.849	43.339	34.465	24.770
652.00	73.525	63.960	60.596	51.939	48.345	38.849	45.339	36.463	26.677
654.00	75.525	65.960	62.596	53.939	50.345	40.849	47.339	38.461	28.446
656.00	77.525	67.960	64.596	55.939	52.345	42.849	49.339	40.461	30.273
658.00	79.525	69.960	66.596	57.939	54.345	44.849	51.339	42.461	32.103

Sam. No.	ZF02	ZF04	ZF06	ZG01	ZG03	ZG05	ZG07
Temp (K)	274.	274.	274.	274.	274.	274.	274.
Path (cm)	1648.	3291.	3291.	1648.	1648.	3291.	3291.
Conc.	0.01910	0.03850	0.15300	0.00500	0.01910	0.03850	0.15300
P (atm)	0.498684	0.123684	0.029868	1.000000	0.248684	0.061842	0.015000
P_e (atm)	0.501542	0.125113	0.031239	1.001500	0.250109	0.062556	0.015689
u ($\#/cm^2$)	4.207E 20	4.200E 20	4.031E 20	2.208E 20	2.098E 20	2.100E 20	2.024E 20
ν (cm^{-1})							
560.00	0.	0.	0.				
562.00	0.	0.	0.				
564.00	0.004	0.002	0.004				
566.00	0.015	0.017	0.021				
568.00	0.035	0.030	0.030				
570.00	0.053	0.053	0.036				
572.00	0.075	0.075	0.126				
574.00	0.092	0.091	0.153				
576.00	0.130	0.115	0.137				
578.00	0.195	0.155	0.250				
580.00	0.250	0.206	0.336				
582.00	0.346	0.276	0.378				
584.00	0.454	0.364	0.455				
586.00	0.593	0.458	0.536				
588.00	0.760	0.566	0.639				
590.00	0.976	0.694	0.739	0.	0.	0.	0.
592.00	1.243	0.947	0.959	0.145	0.145	0.103	0.037
594.00	1.550	1.012	0.946	0.405	0.314	0.206	0.079
596.00	1.916	1.225	1.140	0.663	0.503	0.331	0.141
598.00	2.553	1.659	1.471	1.134	0.867	0.536	0.303
600.00	3.037	1.959	1.661	1.527	1.124	0.741	0.373
602.00	3.491	2.193	1.809	1.903	1.369	0.873	0.431
604.00	3.957	2.450	1.965	2.306	1.634	1.012	0.494
606.00	4.468	2.728	2.144	2.747	1.863	1.165	0.567
608.00	5.003	3.033	2.338	3.202	2.151	1.324	0.650
610.00	5.561	3.352	2.519	3.663	2.445	1.493	0.735
612.00	6.099	3.663	2.731	4.105	2.722	1.656	0.815
614.00	6.632	3.976	2.932	4.525	3.003	1.830	0.906
616.00	7.267	4.372	3.207	4.995	3.350	2.079	1.053
618.00	8.669	5.452	4.037	5.124	4.366	2.337	1.637
620.00	9.683	6.337	4.742	7.152	5.161	3.529	2.047
622.00	10.233	6.677	4.963	7.535	5.451	3.716	2.147
624.00	10.931	7.103	5.234	8.071	5.849	3.959	2.273
626.00	11.919	7.645	5.555	8.757	6.160	4.256	2.427
628.00	13.429	8.229	5.949	9.710	6.974	4.619	2.613
630.00	14.302	9.050	6.411	10.739	7.651	5.043	2.847
632.00	15.720	9.941	6.952	12.050	8.526	5.543	3.115
634.00	17.263	10.955	7.567	13.443	9.433	6.118	3.423
636.00	18.849	12.073	8.251	14.945	10.539	6.766	3.773
638.00	20.593	13.261	9.017	16.546	11.686	7.433	4.169
640.00	22.391	14.534	9.854	18.256	12.924	8.290	4.610
642.00	24.226	15.936	10.721	20.043	14.247	9.173	5.063
644.00	26.101	17.341	11.609	21.865	15.616	10.036	5.572
646.00	28.012	18.815	12.648	23.742	17.057	10.990	6.119
648.00	29.953	20.372	13.767	25.717	18.597	12.342	6.504
650.00	31.940	22.164	15.215	27.696	20.376	13.455	7.034
652.00	33.939	23.993	16.677	29.631	22.154	14.434	7.714
654.00	35.932	25.746	17.933	31.697	23.890	16.095	9.479
656.00	37.928	27.526	19.240	33.676	25.649	17.369	10.233
658.00	39.928	29.116	21.557	35.670	27.425	19.657	10.991

660.00	81.525	71.960	68.596	59.939	56.345	46.849	53.339	44.461	33.930	41.923	31.106	21.865	37.654	29.205	19.936	11.736
662.00	83.525	73.960	70.596	61.939	58.345	48.849	55.339	46.461	35.750	43.922	32.981	23.152	39.656	30.961	21.190	12.479
664.00	85.525	75.960	72.596	63.939	60.345	50.849	57.339	48.461	37.596	45.916	34.696	24.597	41.644	32.745	22.580	13.445
666.00	87.525	77.960	74.596	65.939	62.345	52.849	59.339	50.461	39.515	47.911	36.546	26.049	43.632	34.518	23.938	14.315
668.00	89.525	79.960	76.596	67.939	64.345	54.849	61.339	52.461	41.435	49.911	38.419	27.569	45.627	36.361	25.394	15.375
670.00	91.525	81.960	78.596	69.939	66.345	56.849	63.339	54.461	43.424	51.911	40.404	29.490	47.627	38.346	27.303	17.113
672.00	93.525	83.960	80.596	71.939	68.345	58.849	65.339	56.461	45.380	53.911	42.348	31.158	49.627	40.277	28.960	18.330
674.00	95.525	85.960	82.596	73.939	70.345	60.849	67.339	58.461	47.254	55.911	44.180	32.560	51.627	42.097	30.326	19.176
676.00	97.525	87.960	84.596	75.939	72.345	62.849	69.339	60.461	49.109	57.911	46.013	33.942	53.627	43.908	31.663	20.099
678.00	99.525	89.960	86.596	77.939	74.345	64.849	71.339	62.461	50.967	59.911	47.837	35.329	55.627	45.724	33.046	20.846
680.00	101.525	91.960	88.596	79.939	76.345	66.849	73.339	64.461	52.818	61.911	49.656	36.701	57.627	47.537	34.397	21.675
682.00	103.525	93.960	90.596	81.939	78.345	68.849	75.339	66.461	54.657	63.911	51.461	38.045	59.627	49.329	35.716	22.483
684.00	105.525	95.960	92.596	83.939	80.345	70.849	77.339	68.461	56.479	65.911	53.244	39.337	61.627	51.107	36.969	23.251
686.00	107.525	97.960	94.596	85.939	82.345	72.849	79.339	70.460	58.268	67.911	54.990	40.565	63.627	52.837	38.193	23.962
688.00	109.525	99.960	96.596	87.939	84.345	74.847	81.339	72.453	60.012	69.905	56.686	41.719	65.621	54.518	39.327	24.606
690.00	111.525	101.960	98.596	89.939	86.345	76.837	83.339	74.441	61.742	71.887	58.367	42.885	67.601	56.176	40.472	25.276
692.00	113.525	103.960	100.596	91.939	88.345	78.815	85.339	76.414	63.440	73.851	60.006	44.027	69.561	57.770	41.576	25.925
694.00	115.525	105.960	102.596	93.939	90.345	80.762	87.339	78.357	65.070	75.730	61.524	45.047	71.484	59.258	42.563	26.484
696.00	117.525	107.960	104.596	95.939	92.345	82.668	89.339	80.243	66.511	77.663	62.959	45.983	73.355	60.664	43.478	26.579
698.00	119.525	109.960	106.596	97.939	94.345	84.523	91.339	82.091	67.891	79.493	64.262	46.814	75.164	61.967	44.273	27.415
700.00	121.525	111.960	108.596	99.939	96.345	86.330	93.339	83.885	69.160	81.266	65.497	47.551	76.903	63.168	44.987	27.798
702.00	123.525	113.960	110.596	101.939	98.340	88.104	95.335	85.649	70.373	82.984	66.647	48.232	78.556	64.288	45.641	28.143
704.00	125.525	115.960	112.596	103.930	100.325	89.834	97.312	87.332	71.529	84.611	67.722	48.877	80.094	65.308	46.243	28.467
706.00	127.525	117.960	114.596	105.891	102.275	91.407	99.246	88.873	72.531	86.077	68.660	49.435	81.480	66.190	46.762	28.743
708.00	129.525	119.960	116.596	107.804	104.169	92.823	101.112	90.261	73.398	87.400	69.460	49.897	82.719	66.952	47.198	28.969
710.00	131.525	121.960	118.596	109.670	106.004	94.143	102.902	91.543	74.166	88.604	70.179	50.310	83.820	67.627	47.583	29.163
712.00	133.525	123.959	120.592	111.475	107.759	95.368	104.594	92.709	74.805	89.679	70.811	50.677	84.793	68.216	47.921	29.339
714.00	135.525	125.932	122.559	113.150	109.371	96.456	106.123	93.738	75.485	90.617	71.365	51.001	85.603	68.724	48.214	29.492
716.00	137.525	127.866	124.471	114.677	110.828	97.407	107.503	94.632	76.025	91.428	71.843	51.238	86.286	69.163	48.469	29.627
718.00	139.525	129.775	126.344	116.173	112.223	98.339	108.790	95.403	76.552	92.189	72.259	51.564	86.879	69.579	48.716	29.764
720.00	141.525	131.742	128.276	117.924	113.902	99.696	110.372	96.741	77.477	93.368	73.137	52.116	87.820	70.424	49.253	30.087
722.00	143.525	133.717	130.233	119.785	115.715	101.346	112.115	98.344	78.818	94.566	74.412	53.103	89.210	71.604	50.201	30.729
724.00	145.523	135.507	131.946	121.114	116.894	102.233	113.142	99.147	79.425	95.510	74.933	53.509	89.750	71.988	50.545	30.970
726.00	147.505	137.151	133.461	122.159	117.932	102.759	113.919	99.613	79.728	95.910	75.176	53.665	90.073	72.195	50.669	31.036
728.00	149.493	138.624	135.053	123.251	118.771	103.407	114.749	100.163	80.061	96.377	75.448	53.840	90.434	72.442	50.811	31.112
730.00	151.489	140.538	136.685	124.402	119.905	104.057	115.739	100.745	80.413	96.895	75.744	54.029	90.859	72.716	50.964	31.193
732.00	153.483	142.233	138.358	125.590	120.675	104.728	116.737	101.344	80.776	97.445	76.054	54.222	91.324	73.003	51.124	31.279
734.00	155.436	144.043	140.051	126.757	121.957	105.389	117.756	101.950	81.139	98.002	76.370	54.417	91.806	73.300	51.290	31.365
736.00	157.486	145.801	141.743	127.915	123.024	106.032	118.760	102.543	81.489	98.553	76.661	54.609	92.299	73.595	51.452	31.456
738.00	159.433	147.551	143.420	129.074	124.082	106.667	119.762	103.125	81.833	99.093	76.986	54.799	92.760	73.883	51.611	31.544
740.00	161.486	149.318	145.097	130.274	125.143	107.348	120.745	103.725	82.210	99.635	77.305	55.009	93.219	74.175	51.784	31.644
742.00	163.485	151.143	146.830	131.456	126.333	108.241	121.850	104.505	82.763	100.302	77.751	55.327	93.743	74.553	52.043	31.805
744.00	165.460	152.820	148.440	132.580	127.535	109.054	122.917	105.239	83.281	100.918	78.154	55.636	94.232	74.895	52.284	31.965
746.00	167.374	154.219	149.921	133.711	128.311	109.502	123.644	105.664	83.527	101.300	78.422	55.777	94.541	75.099	52.397	32.034
748.00	169.225	155.518	151.042	134.471	128.999	109.904	124.269	106.035	83.738	101.626	78.611	55.898	94.793	75.275	52.490	32.090
750.00	171.010	156.741	152.161	135.186	129.626	110.285	124.814	106.378	83.937	101.913	78.786	56.014	95.000	75.428	52.550	32.143
752.00	172.710	157.976	153.172	135.846	130.191	110.638	125.279	106.684	84.125	102.159	78.945	56.123				
754.00	174.304	158.910	154.069	136.445	130.689	110.960	125.664	106.956	84.295	102.367	79.089	56.221				
756.00	175.736	159.837	154.850	136.986	131.119	111.253	125.969	107.194	84.449	102.537	79.212	56.311				
758.00	177.172	160.693	155.534	137.496	131.497	111.534	126.221	107.407	84.601	102.675	79.330	56.397				
760.00	178.358	161.389	156.078	137.990	131.799	111.767	126.410	107.576	84.774	102.784	79.424	56.466				
762.00	179.340	161.951	156.435	138.211	132.010	111.951	126.545	107.707	84.928	102.863	79.494	56.524				
764.00	180.174	162.428	156.830	138.489	132.145	112.116	126.652	107.816	84.921	102.926	79.553	56.579				
766.00	180.897	162.837	157.096	138.729	132.325	112.259	126.741	107.903	85.004	102.977	79.603	56.627				
768.00	181.532	163.167	157.315	138.909	132.433	112.377	126.811	107.973	85.077	103.019	79.644	56.674				
770.00	182.059	163.465	157.431	139.066	132.519	112.477	126.877	108.033	85.137	103.055	79.677	56.709				
772.00	182.580	163.749	157.636	139.200	132.593	112.566	126.931	108.083	85.194	103.087	79.700	56.737				
774.00	182.996	163.969	157.757	139.312	132.652	112.642	126.979	108.125	85.246	103.112	79.712	56.758				
776.00	183.303	164.145	157.851	139.401	132.701	112.706	127.020	108.161	85.294	103.129	79.714	56.772				
778.00	183.560	164.296	157.930	139.479	132.741	112.760	127.056	108.192	85.333	103.139	79.714	56.780				
780.00	183.825	164.427	157.997	139.550	132.779	112.810	127.089	108.220	85.359	103.141	79.714	56.781				

* The units of u are molecules/cm^2, abbreviated here by (#/cm^2).

TABLE 20 $\int_{\nu'}^{\nu} A \, d\nu$

Sam. No.	ZH02	ZH04	ZH06	ZH08	ZI01	ZI03	ZI05	ZI07	ZI09
Temp (K)	274.	274.	274.	274.	274.	274.	274.	274.	274.
Path (cm)	1648.	1648.	3291.	3291.	1648.	1648.	1648.	3291.	3291.
Conc.	0.00500	0.01910	0.03850	0.15300	0.00125	0.00500	0.01910	0.03850	0.15300
P (atm)	0.500000	0.124342	0.030921	0.007500	1.000000	0.250000	0.062105	0.015395	0.003684
P_e (atm)	0.500750	0.125055	0.031278	0.007844	1.000375	0.250375	0.062461	0.015573	0.003853
u (#/cm^2)	1.104E 20	1.049E 20	1.050E 20	1.012E 20	5.521E 19	5.521E 19	5.239E 19	5.228E 19	4.972E 19
ν (cm^{-1})									
610.00	0.	0.	0.	0.	0.	0.	0.	0.	0.
612.00	0.099	0.085	0.066	0.031	0.055	0.069	0.054	0.032	0.
614.00	0.209	0.164	0.125	0.061	0.119	0.140	0.104	0.059	0.
616.00	0.344	0.257	0.185	0.094	0.196	0.214	0.156	0.085	0.007
618.00	0.595	0.443	0.371	0.155	0.343	0.347	0.262	0.150	0.049
620.00	0.792	0.564	0.404	0.235	0.468	0.454	0.336	0.190	0.066
622.00	0.952	0.678	0.475	0.275	0.557	0.562	0.404	0.224	0.076
624.00	1.187	0.795	0.546	0.317	0.718	0.671	0.476	0.256	0.084
626.00	1.408	0.923	0.629	0.360	0.862	0.787	0.553	0.283	0.097
628.00	1.644	1.060	0.712	0.411	1.017	0.909	0.635	0.327	0.113
630.00	1.886	1.203	0.799	0.469	1.173	1.039	0.725	0.375	0.138
632.00	2.107	1.337	0.893	0.520	1.308	1.157	0.799	0.411	0.152
634.00	2.322	1.471	0.982	0.578	1.438	1.271	0.892	0.459	0.175
636.00	2.565	1.657	1.105	0.659	1.587	1.404	0.995	0.528	0.212
638.00	3.414	2.424	1.637	0.978	2.253	2.003	1.479	0.631	0.374
640.00	4.138	2.925	2.031	1.281	2.850	2.533	1.871	1.053	0.535
642.00	4.321	3.073	2.179	1.340	2.963	2.634	1.951	1.131	0.559
644.00	4.597	3.276	2.308	1.410	3.124	2.780	2.062	1.193	0.538
646.00	4.986	3.540	2.467	1.495	3.353	2.984	2.206	1.270	0.624
648.00	5.486	3.858	2.657	1.595	3.663	3.247	2.380	1.353	0.666
650.00	6.100	4.237	2.876	1.716	4.066	3.572	2.585	1.463	0.716
652.00	6.827	4.684	3.133	1.859	4.576	3.956	2.823	1.581	0.771
654.00	7.673	5.203	3.427	2.022	5.207	4.414	3.108	1.722	0.839
656.00	8.619	5.799	3.766	2.207	5.955	4.935	3.417	1.886	0.919
658.00	9.656	6.466	4.149	2.416	6.819	5.525	3.774	2.074	1.010
660.00	10.798	7.200	4.576	2.650	7.805	6.185	4.173	2.285	1.113
662.00	12.030	7.976	5.026	2.983	8.908	6.903	4.599	2.515	1.225
664.00	13.342	8.812	5.598	3.170	10.119	7.683	5.058	2.760	1.349
666.00	14.737	9.710	6.041	3.465	11.436	8.531	5.565	3.034	1.483
668.00	16.235	10.762	6.732	3.854	12.869	9.508	6.185	3.403	1.682
670.00	17.958	12.144	7.704	4.512	14.503	10.776	7.126	4.035	2.062
672.00	19.701	13.409	8.565	5.042	16.159	11.993	7.929	4.515	2.348
674.00	21.403	14.681	9.309	5.465	17.796	13.135	8.631	4.908	2.555
676.00	23.136	15.821	10.051	5.873	19.464	14.315	9.345	5.292	2.750
678.00	24.891	17.063	10.795	6.279	21.148	15.522	10.067	5.680	2.943
680.00	26.647	18.291	11.532	6.693	22.828	16.723	10.777	6.061	3.131
682.00	28.378	19.495	12.261	7.068	24.469	17.882	11.473	6.444	3.321
684.00	30.186	20.810	13.191	7.673	26.079	19.079	12.314	6.981	3.627
686.00	31.784	21.989	13.933	8.168	27.619	20.138	12.990	7.405	3.879
688.00	33.603	23.438	15.000	8.498	29.397	21.459	13.962	8.094	4.405

Sam. No.	ZJ01	ZJ02	ZJ04	ZJ06	ZJ08	ZJ10
Temp (K)	274.	274.	274.	274.	274.	274.
Path (cm)	826.	1648.	1648.	1648.	3291.	3291.
Conc.	0.00125	0.00125	0.00500	0.01910	0.03850	0.15300
P (atm)	1.000000	0.500000	0.125000	0.031053	0.007763	0.001868
P_e (atm)	1.000375	0.500188	0.125188	0.031231	0.007853	0.001954
u (#/cm^2)	2.767E 19	2.761E 19	2.761E 19	2.620E 19	2.636E 19	2.581E 19
ν (cm^{-1})						
610.00						
612.00						
614.00						
616.00						
618.00						
620.00						
622.00						
624.00						
626.00						
628.00						
630.00	0.	0.	0.	0.	0.	0.
632.00	0.069	0.066	0.053	0.035	0.016	0.011
634.00	0.137	0.132	0.111	0.075	0.045	0.030
636.00	0.218	0.210	0.192	0.125	0.088	0.053
638.00	0.655	0.611	0.571	0.404	0.250	0.140
640.00	[illegible]	1.054	0.927	0.641	0.398	0.219
642.00	1.172	1.107	0.973	0.660	0.425	0.234
644.00	1.252	1.183	1.044	0.732	0.457	0.251
646.00	1.370	1.294	1.151	0.799	0.497	0.273
648.00	1.532	1.445	1.284	0.879	0.540	0.294
650.00	1.745	1.650	1.442	0.976	0.590	0.318
652.00	2.024	1.907	1.631	1.092	0.647	0.341
654.00	2.392	2.239	1.858	1.229	0.719	0.374
656.00	2.852	2.635	2.127	1.383	0.807	0.415
658.00	3.411	3.101	2.432	1.560	0.901	0.463
660.00	4.081	3.638	2.778	1.760	1.010	0.514
662.00	4.855	4.247	3.155	1.980	1.126	0.566
664.00	5.732	4.929	3.567	2.215	1.251	0.624
666.00	6.712	5.689	4.026	2.477	1.387	0.669
668.00	7.814	6.560	4.592	2.837	1.582	0.798
670.00	9.136	7.687	5.444	3.426	1.937	1.012
672.00	10.459	8.785	6.168	3.862	2.206	1.161
674.00	11.765	9.835	6.519	4.233	2.406	1.261
676.00	13.104	10.921	7.485	4.603	2.602	1.350
678.00	14.462	12.028	8.165	4.979	2.757	1.448
680.00	15.806	13.124	8.837	5.347	2.991	1.529
682.00	17.092	14.170	9.484	5.717	3.185	1.624
684.00	18.334	15.203	10.197	6.199	3.470	1.796
686.00	19.465	16.187	10.756	6.543	3.691	1.916
688.00	20.976	17.346	11.694	7.311	4.284	2.309

690.00	35.591	25.342	16.734	10.355	31.355	23.342	15.679	9.533	5.539	22.894	19.203	13.392	8.726	5.332	3.078
692.00	37.519	26.912	17.947	11.165	33.225	24.931	16.942	10.316	6.015	24.519	20.709	14.492	9.409	5.795	3.320
694.00	39.327	28.219	18.772	11.633	34.965	26.205	17.627	10.758	6.247	25.922	21.879	15.228	9.821	6.026	3.436
696.00	41.127	29.531	19.598	12.092	36.719	27.463	18.412	11.186	6.462	27.365	23.074	15.978	10.236	6.242	3.540
698.00	42.937	30.849	20.413	12.535	38.469	28.779	19.207	11.621	6.678	28.936	24.300	16.741	10.657	6.460	3.646
700.00	44.746	32.155	21.231	12.990	40.263	30.065	19.996	12.056	6.899	30.308	25.524	17.500	11.079	6.680	3.752
702.00	46.543	33.433	22.030	13.435	42.022	31.325	20.764	12.491	7.113	31.760	26.723	18.241	11.487	6.895	3.854
704.00	48.316	34.659	22.791	13.863	43.753	32.536	21.595	12.897	7.314	33.177	27.869	18.948	11.880	7.102	3.955
706.00	50.050	35.813	23.493	14.261	45.444	33.687	22.192	13.265	7.512	34.542	28.981	19.602	12.246	7.295	4.061
708.00	51.729	36.900	24.133	14.619	47.075	34.764	22.816	13.607	7.690	35.830	30.008	20.196	12.576	7.473	4.152
710.00	53.362	37.995	24.890	14.996	48.644	35.908	23.440	13.963	7.881	37.053	30.978	20.776	12.914	7.662	4.250
712.00	54.928	39.003	25.431	15.359	50.130	36.792	24.033	14.303	8.062	38.196	31.978	21.318	13.227	7.834	4.334
714.00	56.339	39.930	25.930	15.660	51.506	37.689	24.558	14.585	8.203	39.213	32.694	21.906	13.498	7.974	4.404
716.00	57.763	40.784	26.471	15.925	52.774	38.518	25.036	14.835	8.326	40.133	33.430	22.242	13.739	8.099	4.468
718.00	59.033	41.545	26.904	16.162	53.925	39.254	25.458	15.059	8.435	40.942	34.077	22.624	13.952	8.210	4.527
720.00	60.189	42.223	27.287	16.369	54.950	39.904	25.832	15.256	8.532	41.642	34.638	22.962	14.141	8.309	4.578
722.00	61.239	42.838	27.630	16.551	55.852	40.481	26.167	15.432	8.619	42.235	35.124	23.256	14.310	8.399	4.624
724.00	62.179	43.390	27.946	16.727	56.631	40.988	26.460	15.593	8.702	42.723	35.537	23.515	14.463	8.483	4.667
726.00	62.990	43.864	28.220	16.879	57.286	41.424	26.731	15.734	8.775	43.119	35.881	23.740	14.595	8.555	4.705
728.00	63.687	44.263	28.451	17.002	57.831	41.791	26.954	15.857	8.831	43.430	36.163	23.929	14.707	8.616	4.738
730.00	64.296	44.605	28.651	17.112	58.275	42.105	27.148	15.952	8.880	43.676	36.395	24.092	14.801	8.668	4.764
732.00	64.814	44.895	28.828	17.213	58.632	42.372	27.316	16.039	8.926	43.869	36.585	24.230	14.883	8.713	4.739
734.00	65.249	45.149	28.994	17.303	58.916	42.557	27.467	16.112	8.965	44.020	36.737	24.347	14.954	8.753	4.812
736.00	65.602	45.366	29.116	17.383	59.139	42.780	27.597	16.177	9.001	44.138	36.859	24.446	15.017	8.790	4.835
738.00	65.910	45.579	29.250	17.469	59.329	42.941	27.727	15.244	9.040	44.241	36.965	24.534	15.052	8.828	4.862
740.00	66.537	46.119	29.595	17.680	59.762	43.327	28.052	16.416	9.137	44.542	37.232	24.780	15.253	8.924	4.923
742.00	67.622	46.986	30.211	18.066	60.644	44.126	28.659	16.775	9.341	45.171	37.857	25.388	15.601	9.121	5.034
744.00	67.982	47.234	30.416	18.201	60.951	44.389	28.851	16.897	9.425	45.301	38.075	25.469	15.714	9.192	5.076
746.00	68.119	47.332	30.480	18.253	61.038	44.461	28.915	16.933	9.447	45.407	38.126	25.516	15.744	9.214	5.093
748.00	68.296	47.450	30.551	18.305	61.152	44.558	28.990	16.972	9.467	45.467	38.191	25.574	15.779	9.238	5.112
750.00	68.509	47.583	30.632	18.364	61.286	44.672	29.068	17.014	9.489	45.541	38.266	25.539	15.818	9.263	5.131
752.00	68.744	47.723	30.722	18.427	61.439	44.796	29.153	17.057	9.513	45.623	38.350	25.709	15.861	9.291	5.152
754.00	68.990	47.868	30.810	18.492	61.603	44.927	29.244	17.100	9.536	45.711	38.438	25.740	15.907	9.319	5.173
756.00	69.236	48.013	30.897	18.544	61.772	45.058	29.335	17.146	9.562	45.755	38.485	25.816	15.930	9.333	5.186
758.00	69.479	48.158	30.992	18.608	61.940	45.186	29.426	17.194	9.590						
760.00	69.713	48.307	31.072	18.675	62.103	45.318	29.520	17.239	9.624						
762.00	69.989	48.500	31.208	18.780	62.282	45.454	29.645	17.312	9.675						
764.00	70.242	48.593	31.343	18.876	62.445	45.596	29.750	17.385	9.727						
766.00	70.396	48.723	31.412	18.923	62.549	45.684	29.816	17.425	9.747						
768.00	70.522	48.869	31.474	18.966	62.631	45.755	29.874	17.461	9.763						
770.00	70.624	48.945	31.529	19.008	62.697	45.815	29.925	17.492	9.774						

* The units of u are molecules/cm^2, abbreviated here by ($\#/cm^2$).

TABLE 21 $\int_{\nu_0}^{\nu} A\,d\nu$

Sam. No.	ZH01	ZH02	ZH04	ZH06	ZH08	ZL01	ZL02	ZL04	ZL06	ZL08	ZM01	ZM02	ZM04	ZM01	ZM02
Temp (K)	274.	274.	274.	274.	274.	274.	274.	274.	274.	274.	274.	274.	274.	274.	274.
Path (cm)	826.	1648.	1648.	1648.	3291.	826.	1648.	1648.	1648.	3291.	826.	1648.	1648.	826.	1648.
Conc.	0.00125	0.00125	0.00500	0.01910	0.03850	0.00125	0.00125	0.00500	0.01910	0.03850	0.00125	0.00125	0.00500	0.00125	0.00125
P (atm)	0.500000	0.250000	0.062500	0.015586	0.003816	0.250000	0.125000	0.031316	0.007763	0.001895	0.125000	0.062500	0.015658	0.062500	0.031316
P_e (atm)	0.500188	0.250094	0.062594	0.015615	0.003860	0.250094	0.125047	0.031363	0.007808	0.001917	0.125047	0.062523	0.015681	0.062523	0.031328
u (#/cm²) *	1.384E 19	1.380E 19	1.380E 19	1.310E 19	1.296E 19	6.918E 18	6.901E 18	6.916E 18	6.549E 18	6.434E 18	3.459E 18	3.451E 18	3.458E 18	1.730E 18	1.729E 18
ν (cm⁻¹)															
610.00	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.					
612.00	0.035	0.035	0.023	0.027	0.	0.017	0.015	0.018	0.	0.					
614.00	0.063	0.070	0.050	0.043	0.005	0.033	0.036	0.047	0.	0.					
616.00	0.114	0.114	0.065	0.172	0.0[illegible]5	0.063	0.062	0.033	0.003	0.032					
618.00	0.439	0.367	0.307	0.210	0.195	0.219	0.212	0.219	0.075	0.071					
620.00	0.655	0.651	0.527	0.354	0.175	0.379	0.358	0.345	0.139	0.043					
622.00	0.632	0.677	0.544	0.374	0.199	0.393	0.371	0.364	0.145	0.063					
624.00	0.721	0.718	0.575	0.413	0.293	0.414	0.391	0.359	0.162	0.063					
626.00	0.777	0.776	0.625	0.437	0.219	0.444	0.415	0.427	0.163	0.063					
628.00	0.955	0.355	0.646	0.475	0.231	0.456	0.456	0.472	0.197	0.053					
630.00	0.960	0.956	0.754	0.572	0.250	0.544	0.506	0.521	0.219	0.053					
632.00	1.116	1.056	0.356	0.575	0.264	0.619	0.548	0.575	0.243	0.043					
634.00	1.311	1.250	0.970	0.642	0.293	0.716	0.650	0.646	0.273	0.076					
636.00	1.553	1.454	1.105	0.715	0.322	0.841	0.757	0.731	0.306	0.092					
638.00	1.855	1.655	1.250	0.327	0.357	0.934	0.876	0.525	0.340	0.114					
640.00	2.206	1.975	1.433	0.935	0.397	1.173	1.019	0.936	0.369	0.138					
642.00	2.615	2.293	1.027	1.016	0.441	1.393	1.120	1.356	0.433	0.151					
644.00	3.067	2.647	1.637	1.135	0.491	1.636	1.358	1.175	0.494	0.172					
646.00	3.622	3.047	2.072	1.267	0.551	1.911	1.562	1.334	0.557	0.222					
648.00	4.256	3.522	2.379	1.449	0.653	2.244	1.815	1.476	0.643	0.275					
650.00	5.037	4.210	2.491	1.774	0.947	2.722	2.210	1.770	0.914	0.386					
652.00	5.879	4.603	3.331	2.017	0.953	3.159	2.545	1.393	0.973	0.467					
654.00	6.641	5.425	3.031	2.207	1.043	3.566	2.947	2.179	1.019	0.514					
656.00	7.426	6.125	4.095	2.397	1.175	3.959	3.153	2.360	1.103	0.566	0.	0.	0.	0.	0.
658.00	8.224	6.634	4.355	2.573	1.265	4.413	3.467	2.546	1.190	0.615	0.213	0.163	0.046	0.119	0.068
660.00	9.005	7.234	4.719	2.766	1.356	4.827	3.773	2.731	1.275	0.667	0.431	0.336	0.178	0.219	0.161
662.00	9.741	7.305	5.059	2.951	1.446	5.214	4.063	2.909	1.361	0.714	0.625	0.493	0.267	0.318	0.235
664.00	10.456	8.377	5.452	3.230	1.536	5.595	4.366	3.115	1.453	0.737	0.826	0.657	0.373	0.421	0.317
666.00	11.045	8.335	5.740	3.283	1.692	5.833	4.592	3.263	1.563	0.957	0.971	0.763	0.443	0.581	0.377
668.00	12.874	9.641	6.335	3.394	2.034	6.592	5.213	3.327	1.965	1.035	1.439	1.243	0.795	0.932	0.712
670.00	13.313	11.239	7.305	4.346	2.360	8.063	6.566	4.838	2.722	1.566	2.665	2.252	1.553	1.767	1.423
672.00	14.563	12.376	8.530	5.489	3.085	9.823	7.202	5.260	2.939	1.307	3.104	2.670	1.742	1.959	1.611
674.00	15.604	13.129	8.910	5.621	3.196	9.273	7.537	5.461	3.040	1.457	3.325	2.456	1.804	2.102	1.639
676.00	16.675	13.695	9.305	5.331	3.300	9.741	7.496	5.666	3.135	1.909	3.561	3.036	1.934	2.224	1.793
678.00	17.573	14.395	9.710	6.047	3.494	10.226	8.245	5.877	3.233	1.354	3.607	3.729	2.096	2.352	1.890
680.00	18.473	15.094	10.112	5.263	3.510	10.714	8.606	6.035	3.331	1.916	4.054	3.420	2.191	2.481	1.998
682.00	19.356	15.779	10.505	6.471	3.612	11.194	8.960	6.259	3.426	1.967					
684.00	23.206	16.437	10.894	6.671	3.707	11.655	9.307	6.456	3.515	2.016					
686.00	21.305	17.057	11.239	6.853	3.795	12.069	9.673	6.672	3.600	2.061					
688.00	21.742	17.606	11.557	7.032	3.377	12.477	9.912	6.847	3.690	2.105					
690.00	22.433	18.122	11.365	7.235	3.968	12.439	10.141	7.009	3.766	2.155					
692.00	23.069	18.617	12.155	7.364	4.049	13.175	10.421	7.159	3.843	2.200					
694.00	23.636	19.053	12.410	7.493	4.109	13.471	10.653	7.232	3.901	2.237					
696.00	24.135	19.437	12.533	7.421	4.157	13.723	10.846	7.417	3.959	2.269					
698.00	24.554	19.770	12.329	7.731	4.215	13.949	11.010	7.513	4.024	2.309					
700.00	24.932	20.055	12.939	7.571	4.261	14.139	11.152	7.631	4.073	2.330					
702.00	25.240	20.307	13.144	7.913	4.302	14.293	11.276	7.675	4.116	2.352					
704.00	25.495	20.512	13.271	7.991	4.344	14.431	11.391	7.744	4.156	2.374					
706.00	25.707	20.667	13.341	8.060	4.379	14.544	11.477	7.806	4.190	2.392					
708.00	25.864	20.532	13.474	8.118	4.405	14.636	11.545	7.856	4.219	2.404					
710.00	25.991	20.947	13.550	8.166	4.429	14.706	11.606	7.895	4.243	2.419					
712.00	26.093	21.033	13.614	8.205	4.448	14.762	11.651	7.925	4.265	2.419					
714.00	26.169	21.109	13.658	8.233	4.463	14.805	11.699	7.954	4.281	2.410					
716.00	26.223	21.165	13.714	8.263	4.474	14.840	11.721	7.979	[illegible]	2.410					
718.00	26.243	21.210	13.757	8.239	4.490	14.871	11.746	8.003	4.314	2.411					
720.00	26.459	21.344	13.942	8.361	4.544	14.956	11.422	8.072	4.370	2.466					
722.00	26.551	21.728	14.147	8.565	4.558	15.152	12.033	8.233	4.488	2.504					
724.00	26.963	21.456	14.258	8.623	4.637	15.263	12.103	8.255	4.548	2.593					
726.00	26.991	21.668	14.335	8.641	4.699	15.272	12.124	8.245	4.590	2.526					
728.00	27.026	21.986	14.373	8.655	4.704	15.296	12.141	8.295	4.593	2.524					
730.00	27.065	21.947	14.356	8.676	4.705	15.304	12.159	8.296	4.500	2.524					
732.00	27.108	21.954	14.397	8.694	4.705	15.323	12.182	8.294	4.500	2.526					
734.00	27.155	22.030	14.421	8.716	4.705	15.344	12.284	8.309	4.503	2.526					
736.00	27.179	22.053	14.443	8.775	4.705	15.355	12.216	8.316	4.500	2.524					

* The units of u are molecules/cm², abbreviated here by (#/cm²).

TABLE 22 $\int_{\nu'}^{\nu} A\,d\nu$

Sam. No.	ZP01	ZP02	ZP03	ZP04	ZP05	ZP06
Temp (K)	274.	274.	274.	274.	274.	274.
Path (cm)	3291.	3291.	3291.	3291.	3291.	3291.
Conc.	1.00000	0.15300	1.00000	0.08090	0.15300	1.00000
P (atm)	0.769737	0.956579	0.385526	0.976316	0.477632	0.192105
P_e (atm)	1.000658	1.000466	0.501184	1.000011	0.499555	0.249737
u^c (#/cm^2)*	6.789E 22	1.291E 22	3.401E 22	6.967E 21	6.446E 21	1.694E 22
ν (cm^{-1})						
500.00	0.	0.	0.	0.	0.	0.
502.00	0.029	0.	0.007	0.	0.	0.016
504.00	0.103	0.	0.034	0.	0.	0.032
506.00	0.132	0.	0.045	0.	0.	0.047
508.00	0.203	0.002	0.082	0.	0.	0.065
510.00	0.308	0.026	0.131	0.	0.	0.092
512.00	0.358	0.039	0.156	0.	0.	0.107
514.00	0.401	0.052	0.178	0.	0.	0.120
516.00	0.465	0.068	0.211	0.	0.	0.144
518.00	0.579	0.091	0.269	0.003	0.	0.176
520.00	0.708	0.119	0.331	0.011	0.001	0.211
522.00	0.846	0.151	0.397	0.026	0.007	0.246
524.00	0.958	0.185	0.469	0.042	0.019	0.288
526.00	1.193	0.228	0.566	0.057	0.034	0.332
528.00	1.444	0.278	0.683	0.078	0.052	0.395
530.00	1.674	0.331	0.792	0.099	0.070	0.448
532.00	1.918	0.385	0.906	0.121	0.084	0.502
534.00	2.152	0.446	1.025	0.146	0.098	0.556
536.00	2.396	0.504	1.143	0.169	0.117	0.604
538.00	2.640	0.554	1.262	0.191	0.136	0.652
540.00	2.831	0.596	1.352	0.213	0.153	0.694
542.00	2.994	0.636	1.425	0.237	0.171	0.731
544.00	3.224	0.721	1.555	0.291	0.215	0.815
546.00	4.571	1.375	2.598	0.663	0.608	1.535
548.00	5.375	1.680	3.058	0.791	0.718	1.773
550.00	5.698	1.680	3.221	0.840	0.768	1.853
552.00	6.036	1.772	3.383	0.893	0.806	1.939
554.00	6.423	1.877	3.566	0.957	0.852	2.040
556.00	6.863	1.991	3.785	1.030	0.909	2.171
558.00	7.343	2.114	4.025	1.103	0.975	2.309
560.00	7.879	2.247	4.298	1.176	1.045	2.458

* The units of u are molecules/cm^2, abbreviated here by (#/cm^2).

TABLE 23 $\int_{\nu'}^{\nu} A\,d\nu$

Sam. No.	ZO01	ZO02	ZO03	ZO04	ZO05	ZO06
Temp (K)	274.	274.	274.	274.	274.	274.
Path (cm)	3291.	3291.	3291.	3291.	3291.	3291.
Conc.	1.00000	0.15300	1.00000	0.08090	0.15300	1.00000
P (atm)	0.769737	0.956579	0.384211	0.976316	0.477632	0.192105
P_e (atm)	1.000658	1.000466	0.499474	1.000011	0.499555	0.249737
u^c (#/cm^2)*	6.789E 22	1.291E 22	3.389E 22	6.967E 21	6.446E 21	1.694E 22
ν (cm^{-1})						
780.00	0.	0.	0.	0.	0.	0.
782.00	0.762	0.207	0.380	0.113	0.103	0.198
784.00	1.434	0.392	0.728	0.208	0.195	0.371
786.00	2.028	0.547	1.007	0.293	0.273	0.518
788.00	2.513	0.673	1.241	0.368	0.339	0.638
790.00	2.948	0.800	1.447	0.437	0.413	0.743
792.00	3.722	1.225	1.971	0.751	0.689	1.074
794.00	4.987	1.918	2.901	1.236	1.159	1.747
796.00	5.847	2.232	3.419	1.428	1.358	2.106
798.00	6.375	2.375	3.683	1.519	1.433	2.242
800.00	6.916	2.533	3.955	1.608	1.528	2.378
802.00	7.485	2.705	4.240	1.704	1.610	2.533
804.00	8.063	2.884	4.537	1.806	1.703	2.688
806.00	8.637	3.064	4.833	1.985	1.798	2.842
808.00	9.198	3.235	5.121	2.082	1.886	2.985
810.00	9.712	3.400	5.386	2.099	1.966	3.120
812.00	10.192	3.547	5.633	2.194	2.045	3.249
814.00	10.632	3.674	5.856	2.275	2.118	3.378
816.00	11.023	3.785	6.054	2.347	2.180	3.473
818.00	11.357	3.882	6.230	2.418	2.238	3.568
820.00	11.639	3.964	6.375	2.467	2.293	3.636
822.00	11.859	4.038	6.491	2.514	2.341	3.698
824.00	12.034	4.094	6.583	2.554	2.379	3.746
826.00	12.176	4.144	6.660	2.596	2.410	3.786
828.00	12.323	4.196	6.745	2.628	2.447	3.831
830.00	12.521	4.254	6.859	2.669	2.487	3.885
832.00	12.651	4.301	6.936	2.702	2.525	3.922
834.00	12.723	4.340	6.986	2.739	2.552	3.942
836.00	12.784	4.366	7.024	2.756	2.567	3.963
838.00	12.841	4.396	7.062	2.774	2.586	3.994
840.00	12.901	4.427	7.102	2.805	2.616	4.011
842.00	12.952	4.464	7.139	2.820	2.645	4.031
844.00	13.000	4.502	7.176	2.850	2.668	4.052
846.00	13.056	4.536	7.216	2.880	2.685	4.073
848.00	13.113	4.566	7.259	2.908	2.710	4.096
850.00	13.168	4.594	7.304	2.943	2.740	4.114

TABLE 24 $\int_{\nu'}^{\nu} A\, d\nu$

Sam. No.	LA01	LB02	LC01	LC03	LD02	LD04	LE01	LE03	LE05	LF02	LF04	LF06	LG01	LG03	LG05	LG07
Temp (K)	248.	248.	247.	249.	244.	244.	244.	244.	244.	244.	244.	244.	246.	244.	245.	244.
Path (cm)	3291.	3291.	3291.	3291.	3291.	3291.	1646.	3291.	3291.	1646.	3291.	3291.	1646.	1646.	3291.	3291.
Conc.	0.15300	0.15300	0.03850	0.15300	0.03850	0.15300	0.01910	0.03850	0.15300	0.01910	0.03850	0.15300	0.00500	0.01910	0.03850	0.15300
P (atm)	0.956579	0.477632	0.988158	0.239474	0.494737	0.119737	0.994737	0.247368	0.059737	0.498684	0.123684	0.029868	1.000000	0.248684	0.061842	0.015000
P_e (atm)	1.000466	0.499555	0.999571	0.250466	0.500451	0.125233	1.000437	0.250226	0.062479	0.501542	0.125113	0.031239	1.001500	0.250109	0.062556	0.015489
u^e (#/cm²)*	1.426E 22	7.122E 21	3.722E 21	3.556E 21	1.887E 21	1.815E 21	9.424E 20	9.433E 20	9.053E 20	4.724E 20	4.717E 20	4.526E 20	2.460E 20	2.356E 20	2.349E 20	2.273E 20
ν (cm^{-1})																
560.00	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.				
562.00	0.071	0.059	0.012	0.030	0.018	0.027	0.	0.	0.	0.	0.	0.				
564.00	0.171	0.120	0.034	0.067	0.025	0.045	0.	0.	0.	0.	0.	0.				
566.00	0.294	0.186	0.063	0.104	0.044	0.058	0.008	0.	0.	0.	0.	0.				
568.00	0.446	0.269	0.101	0.157	0.064	0.083	0.012	0.005	0.002	0.	0.	0.				
570.00	0.643	0.380	0.152	0.219	0.091	0.119	0.042	0.025	0.018	0.	0.	0.				
572.00	0.980	0.521	0.215	0.294	0.128	0.162	0.079	0.049	0.041	0.	0.	0.001				
574.00	1.239	0.701	0.311	0.392	0.161	0.209	0.123	0.076	0.059	0.003	0.000	0.021				
576.00	1.670	0.938	0.437	0.520	0.221	0.277	0.174	0.102	0.085	0.022	0.014	0.046				
578.00	2.248	1.255	0.616	0.693	0.300	0.376	0.245	0.144	0.129	0.052	0.041	0.081				
580.00	2.932	1.639	0.941	0.903	0.403	0.484	0.323	0.201	0.180	0.091	0.075	0.119				
582.00	3.835	2.130	1.157	.173	0.550	0.624	0.426	0.282	0.251	0.140	0.127	0.171				
584.00	4.914	2.761	1.575	1.518	0.750	0.801	0.557	0.390	0.337	0.204	0.187	0.223				
586.00	6.075	3.434	2.065	1.887	0.992	0.994	0.722	0.523	0.433	0.285	0.262	0.284				
588.00	7.388	4.216	2.602	2.332	1.301	1.220	0.945	0.681	0.545	0.396	0.347	0.357				
590.00	9.533	5.107	3.426	2.841	1.677	1.483	1.240	0.872	0.672	0.545	0.440	0.445	0.	0.	0.	0.
592.00	10.487	6.108	4.290	3.408	2.122	1.780	1.601	1.101	0.819	0.726	0.554	0.538	0.114	0.087	0.067	0.039
594.00	12.097	7.223	5.273	4.037	2.640	2.111	2.035	1.375	0.987	0.947	0.690	0.637	0.263	0.193	0.144	0.078
596.00	13.903	8.509	6.407	4.797	3.260	2.522	2.569	1.712	1.194	1.227	0.862	0.756	0.460	0.329	0.235	0.121
598.00	15.856	10.154	7.897	6.000	4.239	3.301	3.412	2.325	1.644	1.713	1.205	1.011	0.813	0.507	0.423	0.234
600.00	17.794	11.662	9.331	6.949	5.077	3.826	4.174	2.774	1.949	2.119	1.441	1.161	1.125	0.792	0.541	0.307
602.00	19.731	13.151	10.727	7.829	5.870	4.294	4.911	3.198	2.194	2.505	1.653	1.287	1.440	0.987	0.651	0.358
604.00	21.693	14.728	12.210	8.794	6.740	4.910	5.721	3.654	2.460	2.931	1.952	1.434	1.793	1.201	0.775	0.410
606.00	23.674	16.376	13.764	9.838	7.669	5.379	6.535	4.155	2.744	3.386	2.150	1.579	2.170	1.425	0.903	0.460
608.00	25.662	18.095	15.377	10.970	8.656	6.005	7.489	4.693	3.057	3.870	2.423	1.742	2.569	1.662	1.047	0.530
610.00	27.661	19.837	17.012	12.115	9.663	6.641	8.405	5.238	3.390	4.361	2.701	1.917	2.971	1.989	1.190	0.605
612.00	29.661	21.596	18.652	13.259	10.667	7.272	9.316	5.779	3.720	4.844	2.982	2.054	3.361	2.145	1.331	0.669
614.00	31.661	23.348	20.297	14.404	11.670	7.984	10.205	6.314	4.044	5.319	3.254	2.261	3.732	2.385	1.477	0.753
616.00	33.661	25.161	21.992	15.662	12.743	8.629	11.140	6.928	4.432	5.818	3.567	2.477	4.097	2.643	1.656	0.859
618.00	35.661	27.125	23.921	17.436	14.412	10.064	12.606	8.257	5.476	7.082	4.511	3.223	5.091	3.492	2.382	1.299
620.00	37.660	29.042	25.800	19.007	15.906	11.242	14.099	9.338	6.387	8.089	5.347	3.841	6.043	4.251	2.930	1.711
622.00	39.654	30.749	27.436	20.158	16.930	11.910	14.978	9.908	6.684	8.466	5.635	4.029	6.361	4.477	3.090	1.770
624.00	41.654	32.559	29.199	21.493	18.170	12.719	16.071	10.641	7.118	9.092	6.019	4.259	6.803	4.803	3.293	1.870
626.00	43.654	34.406	31.103	23.041	19.629	13.707	17.426	11.545	7.646	9.898	6.585	4.538	7.418	5.231	3.545	2.000
628.00	45.654	36.471	33.077	24.771	21.282	14.862	19.997	12.614	8.287	10.883	7.889	4.876	8.196	5.761	3.853	2.149
630.00	47.654	38.471	35.076	26.630	23.083	16.172	20.732	13.842	9.038	12.033	7.776	5.288	9.163	6.399	4.220	2.337
632.00	49.654	40.471	37.076	28.560	24.974	17.640	22.569	15.229	9.922	13.340	8.579	5.758	10.309	7.140	4.656	2.557
634.00	51.654	42.471	39.076	30.522	26.913	19.245	24.471	16.755	10.931	14.781	9.513	6.313	11.613	8.004	5.165	2.821
636.00	53.654	44.471	41.076	32.503	28.879	20.935	26.412	18.384	12.049	16.329	10.560	6.941	13.045	8.975	5.756	3.131
638.00	55.654	46.471	43.076	34.500	30.966	22.715	28.382	20.181	13.283	17.971	11.714	7.654	14.598	10.049	6.429	3.490
640.00	57.654	48.471	45.076	36.500	32.866	24.570	30.373	21.911	14.620	19.726	12.980	8.453	16.231	11.235	7.104	3.898
642.00	59.654	50.471	47.076	38.500	34.866	26.451	32.373	23.763	16.021	21.549	14.320	9.299	18.063	12.513	7.906	4.330
644.00	61.654	52.471	49.076	40.500	36.866	28.375	34.373	25.664	17.511	23.425	15.752	10.228	19.917	13.807	8.868	4.825
646.00	63.654	54.471	51.076	42.500	38.866	30.334	36.373	27.686	19.082	25.347	17.263	11.241	21.826	15.349	9.832	5.369
648.00	65.654	56.471	53.076	44.500	40.866	32.305	38.373	29.566	20.719	27.297	18.855	12.361	23.774	16.890	10.910	6.027
650.00	67.654	58.471	55.076	46.500	42.866	34.296	40.373	31.559	22.558	29.282	20.662	13.813	25.757	18.654	12.323	7.040
652.00	69.654	60.471	57.076	48.500	44.866	36.296	42.373	33.559	24.439	31.282	22.507	15.251	27.756	20.471	13.710	7.956
654.00	71.654	62.471	59.076	50.500	46.866	38.296	44.373	35.559	26.281	33.282	24.310	16.594	29.753	22.245	15.000	8.747
656.00	73.654	64.471	61.076	52.500	48.866	40.296	46.373	37.559	28.146	35.282	26.147	17.952	31.753	24.053	16.327	9.547
658.00	75.654	66.471	63.076	54.500	50.866	42.296	48.373	39.559	30.023	37.282	27.998	19.347	33.753	25.802	17.686	10.363

660.00	77.654	68.471	65.076	56.500	52.866	44.296	50.373	41.559	31.898	39.282	29.850	20.734	35.753	27.711	19.036	11.167
662.00	79.654	70.471	67.076	58.500	54.866	46.296	52.373	43.559	33.764	41.282	31.689	22.182	37.753	29.525	20.359	11.955
664.00	81.654	72.471	69.076	60.500	56.866	48.296	54.373	45.559	35.653	43.282	33.553	23.592	39.753	31.356	21.900	12.960
666.00	83.654	74.471	71.076	62.500	58.866	50.296	56.373	47.559	37.596	45.282	35.455	25.127	41.753	33.191	23.239	13.906
668.00	85.654	76.471	73.076	64.500	60.866	52.296	58.373	49.559	39.551	47.282	37.381	26.712	43.753	35.004	24.700	14.977
670.00	87.654	78.471	75.076	66.500	62.866	54.296	60.373	51.559	41.548	49.282	39.374	26.640	45.753	37.075	26.719	16.731
672.00	89.654	80.471	77.076	68.500	64.866	56.296	62.373	53.559	43.515	51.282	41.333	30.343	47.753	39.021	28.369	17.973
674.00	91.654	82.471	79.076	70.500	66.866	58.296	64.373	55.559	45.422	53.282	43.217	31.790	49.753	40.804	29.779	18.858
676.00	93.654	84.471	81.076	72.500	68.866	60.296	66.373	57.559	47.321	55.282	45.052	33.247	51.753	42.746	31.193	19.743
678.00	95.654	86.471	83.076	74.500	70.866	62.296	68.373	59.559	49.219	57.282	46.969	34.700	53.753	44.607	32.616	20.633
680.00	97.654	88.471	85.076	76.500	72.866	64.296	70.373	61.559	51.114	59.282	48.841	36.130	55.753	46.462	34.022	21.514
682.00	99.654	90.471	87.076	78.500	74.866	66.296	72.373	63.559	52.999	61.282	50.704	37.548	57.753	48.388	35.482	22.369
684.00	101.654	92.471	89.076	80.500	76.866	68.296	74.373	65.559	54.867	63.282	52.547	38.903	59.753	50.130	36.725	23.175
686.00	103.654	94.471	91.076	82.500	78.866	70.296	76.373	67.559	56.700	65.282	54.352	40.199	61.753	51.911	37.974	23.914
688.00	105.654	96.471	93.076	84.500	80.866	72.296	78.373	69.559	58.486	67.281	56.103	41.392	63.752	53.636	39.142	24.502
690.00	107.654	98.471	95.076	86.500	82.866	74.292	80.373	71.554	60.231	69.271	57.807	42.561	65.737	55.302	40.273	25.247
692.00	109.654	100.471	97.076	88.500	84.866	76.275	82.373	73.530	61.930	71.240	59.449	43.688	67.700	56.892	41.330	25.870
694.00	111.654	102.471	99.076	90.500	86.866	78.228	84.373	75.473	63.505	73.174	60.973	44.690	69.627	58.360	42.295	26.423
696.00	113.654	104.471	101.076	92.500	88.866	80.135	86.373	77.367	64.979	75.053	62.399	45.602	71.492	59.742	43.164	26.902
698.00	115.654	106.471	103.076	94.500	90.866	81.983	88.371	79.197	66.331	76.863	63.708	46.411	73.270	60.995	43.932	27.315
700.00	117.654	108.471	105.076	96.500	92.864	83.762	90.364	80.952	67.551	78.596	64.888	47.112	74.969	62.125	44.682	27.678
702.00	119.654	110.471	107.076	98.498	94.846	85.485	92.340	82.635	68.679	80.246	65.969	47.736	76.543	63.143	45.195	27.983
704.00	121.654	112.471	109.076	100.450	96.811	87.133	94.296	84.223	69.727	81.783	66.952	48.309	77.977	64.045	45.726	28.270
706.00	123.654	114.471	111.076	102.415	98.712	88.608	96.159	85.636	70.630	83.140	67.809	48.808	79.246	64.817	46.181	28.508
708.00	125.654	116.471	113.076	104.273	100.524	89.913	97.936	86.881	71.381	84.320	68.521	49.213	80.360	65.465	46.557	28.699
710.00	127.654	118.471	115.076	106.067	102.247	91.107	99.604	88.005	72.058	85.389	69.147	49.569	81.327	66.029	46.881	28.861
712.00	129.654	120.469	117.064	107.779	103.862	92.195	101.149	89.018	72.652	86.327	69.691	49.883	82.147	66.518	47.162	29.004
714.00	131.654	122.430	119.007	109.351	105.325	93.153	102.540	89.888	73.176	87.140	70.162	50.150	82.826	66.939	47.405	29.131
716.00	133.654	124.334	120.881	110.765	106.636	93.985	103.769	90.648	73.626	87.834	70.567	50.380	83.385	67.296	47.615	29.245
718.00	135.654	126.193	122.683	112.113	107.855	94.771	104.867	91.343	74.040	88.444	70.931	50.596	83.854	67.617	47.812	29.350
720.00	137.654	128.115	124.547	113.733	109.370	95.966	106.234	92.436	74.772	89.394	71.626	51.049	84.629	68.271	48.262	29.606
722.00	139.654	130.059	126.501	115.589	111.151	97.564	107.958	93.952	76.045	90.825	72.822	51.972	85.931	69.390	49.147	30.209
724.00	141.650	131.950	128.161	116.835	112.219	99.356	109.916	94.626	76.627	91.423	73.265	52.333	86.441	69.739	49.432	30.437
726.00	143.620	133.402	129.570	117.746	112.996	98.536	109.596	95.024	76.874	91.754	73.461	52.452	86.687	69.989	49.535	30.493
728.00	145.5[illegible]2	134.986	131.059	118.719	113.861	99.367	110.366	95.486	77.149	92.154	73.694	52.587	87.003	70.121	49.662	30.565
730.00	147.591	136.528	132.615	119.763	114.799	99.946	111.234	95.996	77.448	92.609	73.950	52.738	87.376	70.362	49.801	30.686
732.00	149.577	138.[illegible]1	134.218	120.838	115.777	100.547	112.151	96.528	77.759	93.094	74.219	52.890	87.794	70.617	49.946	30.718
734.00	151.577	140.81[illegible]	135.840	121.925	116.765	101.145	113.070	97.065	78.072	93.587	74.495	53.043	88.207	70.876	50.092	30.785
736.00	153.575	141.700	137.458	122.987	117.739	101.728	113.996	97.591	78.380	94.078	74.763	53.191	88.626	71.130	50.236	30.855
738.00	155.566	143.380	139.040	124.025	118.680	102.292	114.885	98.096	78.668	94.536	75.021	53.334	89.027	71.376	50.376	30.926
740.00	157.552	145.039	140.603	125.060	119.602	102.863	115.743	98.596	78.961	94.936	75.277	53.450	89.407	71.616	50.515	31.009
742.00	159.539	146.769	142.222	126.289	120.667	103.615	116.677	99.219	79.369	95.499	75.615	53.701	89.810	71.902	50.707	31.113
744.00	161.486	148.380	143.781	127.404	121.633	104.301	117.549	99.800	79.796	95.990	75.951	53.944	90.176	72.159	50.897	31.230
746.00	163.329	149.664	145.001	128.126	122.279	104.683	118.150	100.148	80.007	96.303	76.137	54.052	90.413	72.323	50.983	31.294
748.00	165.090	150.828	146.079	128.772	122.844	105.019	119.653	100.452	80.183	96.562	76.295	54.147	90.598	72.462	51.069	31.336
750.00	165.731	151.983	147.040	129.367	123.340	105.326	119.071	100.719	80.355	96.778	76.432	54.223	90.748	72.577	51.144	31.381
752.00	168.264	152.881	147.895	129.899	123.769	105.684	119.418	100.949	80.500	96.957	76.551	54.296				
754.00	169.659	153.745	148.685	130.378	124.132	105.849	119.678	101.142	80.638	97.091	76.655	54.360				
756.00	170.905	154.502	149.195	130.789	124.425	106.066	119.893	101.302	80.756	97.193	76.742	54.415				
758.00	172.023	155.167	149.694	131.158	124.659	106.257	120.050	101.436	80.864	97.270	76.814	54.465				
760.00	172.962	155.711	150.056	131.455	124.836	106.418	120.185	101.539	80.952	97.329	76.867	54.509				
762.00	173.715	156.130	150.324	131.697	124.961	106.544	120.279	101.613	81.022	97.372	76.911	54.541				
764.00	174.317	156.467	150.532	131.877	125.054	106.645	120.354	101.674	81.079	97.407	76.952	54.572				
766.00	174.812	156.732	150.693	132.031	125.125	106.724	120.419	101.724	81.127	97.432	76.990	54.595				
768.00	175.225	156.946	150.813	132.154	125.181	106.786	120.469	101.766	81.165	97.445	77.019	54.615				
770.00	175.556	157.117	150.908	132.258	125.224	106.836	120.515	101.800	81.195	97.448	77.035	54.635				
772.00	175.835	157.262	150.983	132.349	125.258	106.878	120.557	101.837	81.223	97.448	77.038	54.654				
774.00	176.072	157.388	151.049	132.428	125.235	106.915	120.597	101.865	81.243	97.448	77.038	54.655				
776.00	176.255	157.493	151.105	132.494	125.304	106.948	120.631	101.890	81.26[illegible]	97.448	77.038	54.655				
778.00	176.422	157.566	151.151	132.551	125.324	106.976	120.664	101.911	81.287	97.448	77.038	54.655				
780.00	176.577	157.644	151.194	132.611	125.344	106.994	120.702	101.931	81.311	97.448	77.038	54.655				

* The units of u are molecules/cm^2, abbreviated here by (#/cm^2).

TABLE 25 $\int_{\nu'}^{\nu} A\,d\nu$

Sam. No.	LH02	LH04	LH06	LH08	LI01	LI03	LI05	LI07	LI09
Temp (K)	243.	245.	245.	244.	245.	246.	245.	245.	243.
Path (cm)	1648.	1648.	3291.	3291.	1648.	1648.	1648.	3291.	3291.
Conc.	0.00500	0.01910	0.03850	0.15300	0.00125	0.00500	0.01910	0.03850	0.15300
P (atm)	0.500000	0.123684	0.030921	0.007500	1.000000	0.250000	0.062105	0.015395	0.003750
P_e (atm)	0.500750	0.124393	0.031278	0.007844	1.000375	0.250375	0.062461	0.015573	0.003922
u_i^c (#/cm^2)*	1.245E 20	1.167E 20	1.174E 20	1.137E 20	6.175E 19	6.100E 19	5.860E 19	5.847E 19	5.706E 19
ν (cm^{-1})									
590.00	0.	0.	0.	0.	0.	0.	0.	0.	0.
592.00	0.068	0.042	0.039	0.023	0.043	0.033	0.035	0.017	0.016
594.00	0.150	0.092	0.076	0.048	0.093	0.070	0.072	0.039	0.031
596.00	0.254	0.157	0.124	0.083	0.150	0.114	0.113	0.062	0.049
598.00	0.433	0.279	0.222	0.152	0.271	0.192	0.187	0.111	0.094
600.00	0.601	0.376	0.282	0.192	0.376	0.270	0.251	0.148	0.126
602.00	0.765	0.476	0.335	0.224	0.485	0.347	0.311	0.182	0.149
604.00	0.946	0.582	0.396	0.264	0.610	0.431	0.375	0.217	0.172
606.00	1.142	0.697	0.460	0.304	0.743	0.526	0.442	0.247	0.191
608.00	1.340	0.816	0.531	0.355	0.883	0.625	0.510	0.278	0.216
610.00	1.556	0.939	0.608	0.402	1.024	0.730	0.577	0.317	0.245
612.00	1.752	1.053	0.682	0.439	1.161	0.829	0.641	0.358	0.275
614.00	1.938	1.171	0.759	0.483	1.290	0.921	0.714	0.384	0.304
616.00	2.129	1.297	0.840	0.540	1.418	1.015	0.795	0.431	0.339
618.00	2.838	1.868	1.271	0.805	1.939	1.469	1.190	0.680	0.484
620.00	3.496	2.414	1.693	1.056	2.535	1.955	1.577	0.915	0.631
622.00	3.647	2.520	1.775	1.096	2.642	2.059	1.637	0.956	0.661
624.00	3.872	2.683	1.879	1.153	2.786	2.164	1.726	1.011	0.695
626.00	4.194	2.899	2.005	1.222	2.985	2.319	1.846	1.076	0.731
628.00	4.614	3.172	2.160	1.299	3.240	2.526	1.990	1.155	0.770
630.00	5.144	3.502	2.346	1.392	3.591	2.792	2.165	1.249	0.817
632.00	5.793	3.886	2.567	1.507	4.029	3.123	2.372	1.355	0.874
634.00	6.564	4.344	2.821	1.639	4.585	3.527	2.615	1.485	0.944
636.00	7.445	4.877	3.119	1.792	5.266	3.997	2.893	1.628	1.025
638.00	8.429	5.482	3.469	1.971	6.076	4.538	3.215	1.803	1.113
640.00	9.534	6.164	3.870	2.171	7.025	5.155	3.586	2.003	1.217
642.00	10.753	6.899	4.304	2.392	8.113	5.842	3.993	2.224	1.339
644.00	12.081	7.712	4.781	2.642	9.332	6.613	4.447	2.468	1.474
646.00	13.508	8.604	5.315	2.925	10.676	7.469	4.949	2.739	1.622
648.00	15.030	9.606	5.951	3.286	12.142	8.422	5.558	3.096	1.824
650.00	16.776	10.947	6.946	3.932	13.805	9.692	6.501	3.729	2.210
652.00	18.568	12.255	7.831	4.455	15.515	10.960	7.310	4.218	2.495
654.00	20.317	13.471	8.591	4.870	17.218	12.143	8.045	4.610	2.714
656.00	22.110	14.731	9.372	5.288	18.961	13.381	8.797	5.013	2.934
658.00	23.927	16.026	10.170	5.712	20.727	14.655	9.560	5.423	3.155

Sam. No.	LJ01	LJ02	LJ04	LJ06	LJ08	LJ10
Temp (K)	245.	245.	245.	245.	246.	243.
Path (cm)	826.	1648.	1648.	1648.	3291.	3291.
Conc.	0.00125	0.00125	0.00500	0.01910	0.03850	0.15300
P (atm)	1.000000	0.500000	0.125000	0.031053	0.007763	0.001842
P_e (atm)	1.000375	0.500188	0.125188	0.031231	0.007853	0.001927
u_i^c (#/cm^2)*	3.095E 19	3.087E 19	3.087E 19	2.930E 19	2.934E 19	2.803E 19
ν (cm^{-1})						
610.00	0.	0.	0.	0.	0.	0.
612.00	0.060	0.062	0.052	0.035	0.024	0.011
614.00	0.130	0.128	0.098	0.076	0.050	0.024
616.00	0.190	0.174	0.152	0.119	0.086	0.039
618.00	0.578	0.580	0.459	0.328	0.208	0.114
620.00	0.951	0.884	0.793	0.566	0.345	0.195
622.00	0.997	0.920	0.825	0.591	0.366	0.213
624.00	1.065	0.978	0.882	0.638	0.398	0.231
626.00	1.168	1.067	0.961	0.699	0.433	0.250
628.00	1.300	1.187	1.069	0.775	0.475	0.269
630.00	1.478	1.354	1.206	0.867	0.527	0.295
632.00	1.712	1.573	1.374	0.969	0.579	0.327
634.00	2.025	1.853	1.573	1.090	0.643	0.360
636.00	2.431	2.203	1.808	1.236	0.720	0.408
638.00	2.944	2.632	2.083	1.393	0.809	0.449
640.00	3.577	3.145	2.403	1.584	0.916	0.507
642.00	4.336	3.739	2.760	1.795	1.033	0.566
644.00	5.223	4.423	3.162	2.027	1.158	0.632
646.00	6.234	5.194	3.616	2.285	1.308	0.702
648.00	7.377	6.075	4.153	2.611	1.495	0.818
650.00	8.753	7.230	5.011	3.203	1.863	1.037
652.00	10.141	8.373	5.764	3.671	2.135	1.156
654.00	11.530	9.481	6.443	4.056	2.345	1.269
656.00	12.963	10.635	7.151	4.447	2.554	1.398
658.00	14.424	11.822	7.879	4.840	2.763	1.496

660.00	25.740	17.317	10.958	6.131	22.493	15.928	10.325	5.832	3.372	15.875	13.001	8.596	5.242	2.971	1.602
662.00	27.549	18.578	11.730	6.549	24.227	17.164	11.069	6.239	3.599	17.281	14.135	9.291	5.634	3.179	1.712
664.00	29.345	19.933	12.701	7.161	25.934	18.436	11.964	6.813	3.951	18.649	15.261	10.060	6.154	3.494	1.891
666.00	31.113	21.208	13.560	7.677	27.587	19.586	12.690	7.260	4.227	19.916	16.258	10.668	6.540	3.730	2.027
668.00	32.937	22.631	14.590	8.402	29.411	20.960	13.720	7.998	4.803	21.584	17.625	11.613	7.216	4.254	2.434
670.00	34.979	24.540	16.336	9.469	31.395	22.868	15.455	9.446	5.944	23.443	19.513	13.332	8.661	5.378	3.210
672.00	36.916	26.168	17.545	10.656	33.293	24.496	16.573	10.173	6.391	25.114	20.965	14.446	9.389	5.814	3.437
674.00	38.768	27.516	18.400	11.136	35.102	25.831	17.386	10.621	6.650	26.624	22.224	15.210	9.834	6.051	3.562
676.00	40.624	28.575	19.261	11.615	36.923	27.176	18.217	11.074	6.902	28.168	23.497	15.992	10.279	6.286	3.681
678.00	42.407	30.242	20.130	12.097	38.759	28.539	19.058	11.532	7.156	29.739	24.793	16.796	10.731	6.520	3.802
680.00	44.348	31.595	20.989	12.573	40.593	29.895	19.890	11.980	7.411	31.307	26.086	17.593	11.179	6.751	3.925
682.00	46.198	32.918	21.825	13.030	42.415	31.224	20.700	12.429	7.657	32.853	27.350	18.370	11.614	6.977	4.046
684.00	48.023	34.185	22.619	13.481	44.210	32.500	21.463	12.849	7.890	34.357	28.565	19.108	12.027	7.193	4.154
686.00	49.805	35.379	23.340	13.885	45.961	33.708	22.163	13.236	8.106	35.790	29.711	19.780	12.406	7.397	4.254
688.00	51.530	36.490	24.003	14.248	47.646	34.834	22.792	13.581	8.305	37.157	30.772	20.400	12.742	7.579	4.346
690.00	53.160	37.546	24.643	14.609	49.255	35.890	23.393	13.916	8.506	38.425	31.759	20.969	13.058	7.757	4.440
692.00	54.762	38.534	25.250	14.940	50.771	36.873	23.951	14.230	8.689	39.595	32.661	21.495	13.356	7.931	4.525
694.00	56.210	39.429	25.782	15.229	52.165	37.760	24.447	14.496	8.859	40.645	33.465	21.959	13.616	8.076	4.596
696.00	57.564	40.241	26.254	15.474	53.430	38.564	24.880	14.728	8.975	41.572	34.176	22.386	13.842	8.203	4.655
698.00	58.788	40.956	26.666	15.680	54.554	39.270	25.270	14.929	9.091	42.372	34.791	22.744	14.042	8.314	4.709
700.00	59.870	41.580	27.023	15.860	55.530	39.879	25.600	15.105	9.193	43.045	35.310	23.040	14.213	8.411	4.757
702.00	60.825	42.127	27.336	16.021	56.383	40.406	25.884	15.258	9.277	43.596	35.745	23.309	14.361	8.493	4.801
704.00	61.653	42.603	27.616	16.159	57.093	40.858	26.132	15.400	9.356	44.036	36.105	23.551	14.489	8.566	4.839
706.00	62.357	43.005	27.851	16.280	57.674	41.241	26.344	15.523	9.420	44.376	36.395	23.719	14.599	8.630	4.873
708.00	62.958	43.337	28.040	16.374	58.139	41.562	26.522	15.622	9.484	44.638	36.625	23.877	14.688	8.687	4.902
710.00	63.458	43.623	28.215	16.454	58.509	41.834	26.677	15.708	9.530	44.835	36.804	24.010	14.766	8.734	4.925
712.00	63.883	43.870	28.362	16.523	58.804	42.058	26.812	15.781	9.572	44.988	36.944	24.119	14.835	8.780	4.945
714.00	64.234	44.080	28.489	16.580	59.035	42.241	26.927	15.844	9.609	45.107	37.052	24.213	14.890	8.819	4.966
716.00	64.519	44.260	28.596	16.628	59.219	42.390	27.028	15.899	9.643	45.203	37.136	24.289	14.930	8.853	4.985
718.00	64.759	44.425	28.701	16.674	59.375	42.513	27.123	15.953	9.684	45.285	37.207	24.353	14.985	8.890	5.007
720.00	65.229	44.822	28.956	16.809	59.730	42.792	27.374	16.093	9.765	45.480	37.406	24.522	15.121	8.969	5.057
722.00	66.223	45.635	29.543	17.144	60.539	43.525	27.921	16.426	9.955	46.027	37.942	24.993	15.440	9.159	5.157
724.00	66.563	45.870	29.744	17.253	60.818	43.772	28.077	16.539	10.045	46.240	38.105	25.145	15.532	9.230	5.202
726.00	66.684	45.956	29.801	17.279	60.904	43.828	28.127	16.567	10.074	46.280	38.139	25.178	15.557	9.249	5.217
728.00	66.847	46.061	29.863	17.295	61.014	43.906	28.180	16.596	10.102	46.334	38.182	25.725	15.586	9.269	5.230
730.00	67.038	46.179	29.936	17.319	61.143	44.000	28.256	16.627	10.136	46.402	38.237	25.270	15.618	9.291	5.242
732.00	67.240	46.305	30.011	17.343	61.286	44.105	28.325	16.666	10.169	46.476	38.256	25.341	15.654	9.313	5.254
734.00	67.463	46.434	30.089	17.367	61.434	44.216	28.396	16.704	10.197	46.554	38.363	25.404	15.688	9.334	5.264
736.00	67.679	46.560	30.164	17.390	61.582	44.329	28.466	16.739	10.226	46.592	38.397	25.434	15.705	9.344	5.269
738.00	67.886	46.681	30.241	17.414	61.724	44.432	28.535	16.774	10.254						
740.00	68.092	46.798	30.320	17.443	61.859	44.534	28.598	16.809	10.283						
742.00	68.293	46.944	30.438	17.498	61.994	44.646	28.674	16.853	10.327						
744.00	68.486	47.078	30.532	17.550	62.118	44.751	28.746	16.904	10.370						
746.00	68.612	47.159	30.589	17.573	62.200	44.819	28.792	16.934	10.397						
748.00	68.711	47.230	30.638	17.590	62.260	44.871	28.831	16.956	10.420						
750.00	68.790	47.291	30.683	17.607	62.325	44.915	28.863	16.975	10.440						

* The units of u are molecules/cm^2, abbreviated here by $(\#/cm^2)$.

TABLE 26 $\int_{\nu'}^{\nu} A\,d\nu$

Sam. No.	LK01	LK02	LK04	LK06	LK08	LL01	LL02	LL04	LL06	LM01	LM02	LM04	LN01	LN02
Temp (K)	245.	245.	245.	245.	243.	246.	245.	245.	245.	246.	245.	246.	246.	245.
Path (cm)	826.	1648.	1648.	1648.	3291.	826.	1648.	1648.	1648.	826.	1648.	1648.	826.	1648.
Conc.	0.00125	0.00125	0.00500	0.01910	0.03850	0.00125	0.00125	0.00500	0.01910	0.00125	0.00125	0.00500	0.00125	0.00125
P (atm)	0.500000	0.250000	0.062500	0.015526	0.003816	0.250000	0.125000	0.031316	0.007763	0.125000	0.062500	0.015658	0.062500	0.031316
P_e (atm)	0.500188	0.250094	0.062594	0.015615	0.003860	0.250094	0.125047	0.031363	0.007808	0.125047	0.062523	0.015681	0.062523	0.031328
u* (#/cm²)*	1.547E 19	1.544E 19	1.544E 19	1.465E 19	1.461E 19	7.706E 18	7.718E 18	7.735E 18	7.324E 18	3.853E 18	3.859E 18	3.852E 18	1.926E 18	1.934E 18
ν (cm⁻¹)														
610.00	0.	0.	0.	0.	0.	0.	0.	0.	0.					
612.00	0.037	0.028	0.031	0.021	0.018	0.028	0.008	0.013	0.012					
614.00	0.068	0.054	0.060	0.049	0.034	0.032	0.015	0.025	0.024					
616.00	0.101	0.081	0.093	0.079	0.054	0.052	0.027	0.041	0.039					
618.00	0.297	0.265	0.269	0.190	0.121	0.158	0.137	0.138	0.090					
620.00	0.551	0.515	0.471	0.315	0.196	0.381	0.263	0.237	0.148					
622.00	0.571	0.525	0.486	0.329	0.208	0.389	0.263	0.242	0.148					
624.00	0.604	0.550	0.512	0.353	0.229	0.324	0.273	0.254	0.155					
626.00	0.653	0.596	0.555	0.387	0.253	0.347	0.289	0.272	0.166					
628.00	0.716	0.642	0.613	0.425	0.276	0.375	0.312	0.295	0.179					
630.00	0.802	0.717	0.688	0.469	0.306	0.417	0.345	0.338	0.194					
632.00	0.928	0.819	0.779	0.518	0.338	0.473	0.392	0.377	0.213					
634.00	1.079	0.954	0.893	0.577	0.371	0.545	0.453	0.429	0.237					
636.00	1.290	1.129	1.008	0.643	0.415	0.648	0.534	0.489	0.267					
638.00	1.557	1.346	1.154	0.728	0.465	0.780	0.636	0.560	0.301					
640.00	1.899	1.606	1.323	0.808	0.519	0.947	0.762	0.644	0.341					
642.00	2.286	1.911	1.515	0.907	0.580	1.147	0.909	0.740	0.356					
644.00	2.757	2.263	1.731	1.021	0.650	1.391	1.082	0.850	0.439					
646.00	3.384	2.669	1.974	1.147	0.722	1.655	1.283	0.970	0.496					
648.00	3.933	3.146	2.283	1.318	0.828	1.981	1.536	1.128	0.583					
650.00	4.796	3.879	2.821	1.654	1.035	2.475	1.957	1.422	0.769					
652.00	5.639	4.529	3.252	1.906	1.186	2.932	2.308	1.642	0.906					
654.00	6.451	5.144	3.624	2.101	1.305	3.356	2.630	1.825	1.002					
656.00	7.302	5.790	4.008	2.290	1.425	3.798	2.961	2.014	1.097	0.	0.	0.	0.	0.
658.00	8.179	6.453	4.404	2.498	1.543	4.254	3.302	2.208	1.196	0.233	0.164	0.095	0.119	0.094
660.00	9.047	7.105	4.792	2.693	1.658	4.706	3.635	2.398	1.295	0.460	0.324	0.197	0.237	0.189
662.00	9.872	7.726	5.169	2.892	1.774	5.132	3.951	2.583	1.392	0.675	0.476	0.277	0.349	0.279
664.00	10.654	8.364	5.613	3.167	1.953	5.563	4.285	2.810	1.532	0.896	0.640	0.395	0.467	0.378
666.00	11.362	8.969	5.936	3.355	2.092	5.895	4.528	2.966	1.629	1.057	0.751	0.477	0.550	0.450
668.00	12.433	9.780	6.626	3.885	2.499	6.598	5.164	3.474	2.028	1.595	1.244	0.963	0.979	0.771
670.00	14.211	11.457	8.054	4.986	3.286	8.092	6.540	4.569	2.816	2.762	2.278	1.638	1.842	1.527
672.00	15.486	12.437	8.727	5.372	3.508	8.861	7.138	4.959	3.032	3.178	2.591	1.836	2.065	1.724
674.00	16.316	13.138	9.143	5.589	3.633	9.335	7.493	5.164	3.140	3.417	2.761	1.943	2.198	1.822
676.00	17.263	13.856	9.572	5.806	3.758	9.835	7.969	5.371	3.247	3.669	2.941	2.051	2.322	1.923
678.00	18.237	14.600	10.011	6.029	3.884	10.353	8.254	5.556	3.358	3.931	3.127	2.168	2.456	2.029
680.00	19.213	15.344	10.448	6.251	4.008	10.873	8.641	5.799	3.470	4.193	3.313	2.278	2.589	2.131
682.00	20.164	16.069	10.874	6.466	4.125	11.381	9.020	6.007	3.576					
684.00	21.075	16.757	11.238	6.673	4.240	11.865	9.392	6.218	3.679					
686.00	21.938	17.391	11.655	6.864	4.344	12.315	9.715	6.399	3.776					
688.00	22.713	17.962	11.991	7.036	4.438	12.720	10.013	6.569	3.864					
690.00	23.430	18.495	12.308	7.197	4.534	13.087	10.279	6.723	3.945					
692.00	24.030	18.963	12.588	7.350	4.620	13.420	10.521	6.866	4.021					
694.00	24.656	19.384	12.842	7.482	4.692	13.715	10.733	6.993	4.086					
696.00	25.154	19.753	13.064	7.599	4.755	13.965	10.915	7.108	4.140					
698.00	25.579	20.065	13.255	7.708	4.809	14.176	11.068	7.191	4.186					
700.00	25.929	20.326	13.418	7.788	4.859	14.349	11.199	7.268	4.229					
702.00	26.212	20.542	13.558	7.866	4.903	14.487	11.307	7.334	4.265					
704.00	26.437	20.719	13.680	7.937	4.944	14.598	11.397	7.398	4.295					
706.00	26.613	20.861	13.797	7.998	4.991	14.654	11.469	7.438	4.323					
708.00	26.744	20.971	13.876	8.047	5.012	14.749	11.524	7.478	4.344					
710.00	26.846	21.054	13.950	8.088	5.038	14.794	11.566	7.508	4.365					
712.00	26.929	21.116	14.014	8.124	5.060	14.829	11.598	7.531	4.382					
714.00	26.992	21.167	14.067	8.157	5.083	14.856	11.623	7.551	4.399					
716.00	27.044	21.202	14.113	8.187	5.104	14.878	11.643	7.566	4.416					
718.00	27.059	21.233	14.158	8.219	5.126	14.899	11.662	7.586	4.436					
720.00	27.210	21.339	14.257	8.296	5.176	14.961	11.721	7.636	4.474					
722.00	27.549	21.660	14.539	8.469	5.278	15.146	11.904	7.781	4.565					
724.00	27.664	21.753	14.639	8.520	5.319	15.203	11.963	7.834	4.600					
726.00	27.696	21.765	14.665	8.537	5.330	15.208	11.972	7.843	4.600					
728.00	27.712	21.781	14.694	8.555	5.342	15.217	11.981	7.850	4.600					
730.00	27.745	21.805	14.725	8.574	5.357	15.228	11.993	7.859	4.600					
732.00	27.781	21.831	14.763	8.593	5.373	15.242	12.005	7.866	4.600					
734.00	27.815	21.862	14.802	8.613	5.386	15.257	12.021	7.874	4.600					
735.00	27.833	21.878	14.828	8.623	5.392	15.264	12.030	7.878	4.600					

* The units of u are molecules/cm², abbreviated here by (#/cm²).

TABLE 27 $\int_{\nu'}^{\nu} A\,d\nu$

Sam. No.	LP01
Temp (K)	249.
Path (cm)	3291.
Conc.	1.00000
P (atm)	0.769737
P_e (atm)	1.000658
u^e (#/cm^2)*	7.471E 22

ν (cm^{-1})	
500.00	0.
502.00	0.015
504.00	0.049
506.00	0.071
508.00	0.114
510.00	0.168
512.00	0.197
514.00	0.230
516.00	0.269
518.00	0.328
520.00	0.402
522.00	0.485
524.00	0.584
526.00	0.706
528.00	0.862
530.00	1.012
532.00	1.171
534.00	1.334
536.00	1.500
538.00	1.665
540.00	1.798
542.00	1.914
544.00	2.089
546.00	3.256
548.00	3.756
550.00	3.960
552.00	4.183
554.00	4.426
556.00	4.709
558.00	5.019
560.00	5.356

* The units of u are molecules/cm^2, abbreviated here by (#/cm^2).

Sam. No.	LQ01
Temp (K)	249.
Path (cm)	3291.
Conc.	1.00000
P (atm)	0.769737
P_e (atm)	1.000658
u^e (#/cm^2)*	7.471E 22

ν (cm^{-1})	
780.00	0.
782.00	0.552
784.00	1.056
786.00	1.498
788.00	1.884
790.00	2.230
792.00	2.859
794.00	3.971
796.00	4.669
798.00	5.091
800.00	5.532
802.00	5.997
804.00	6.470
806.00	6.940
808.00	7.382
810.00	7.796
812.00	8.177
814.00	8.507
816.00	8.799
818.00	9.051
820.00	9.257
822.00	9.431
824.00	9.580
826.00	9.708
828.00	[illegible].833
830.00	9.966
832.00	10.066
834.00	10.140
836.00	10.222
838.00	10.292
840.00	10.368
842.00	10.446
844.00	10.521
846.00	10.590
848.00	10.644
850.00	10.703

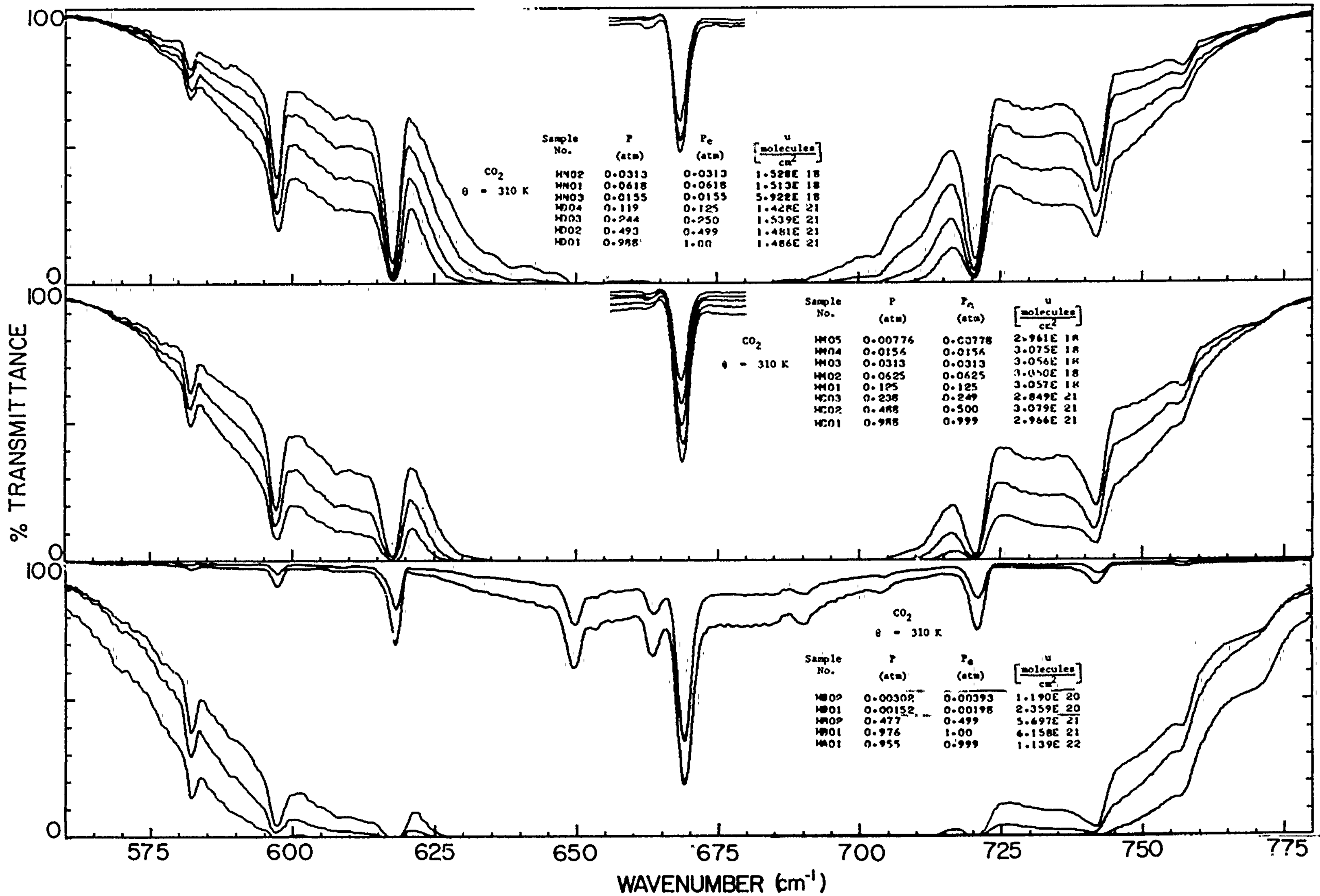

Figure 10. Spectral plots of transmittance of several CO_2 samples near 310 K.

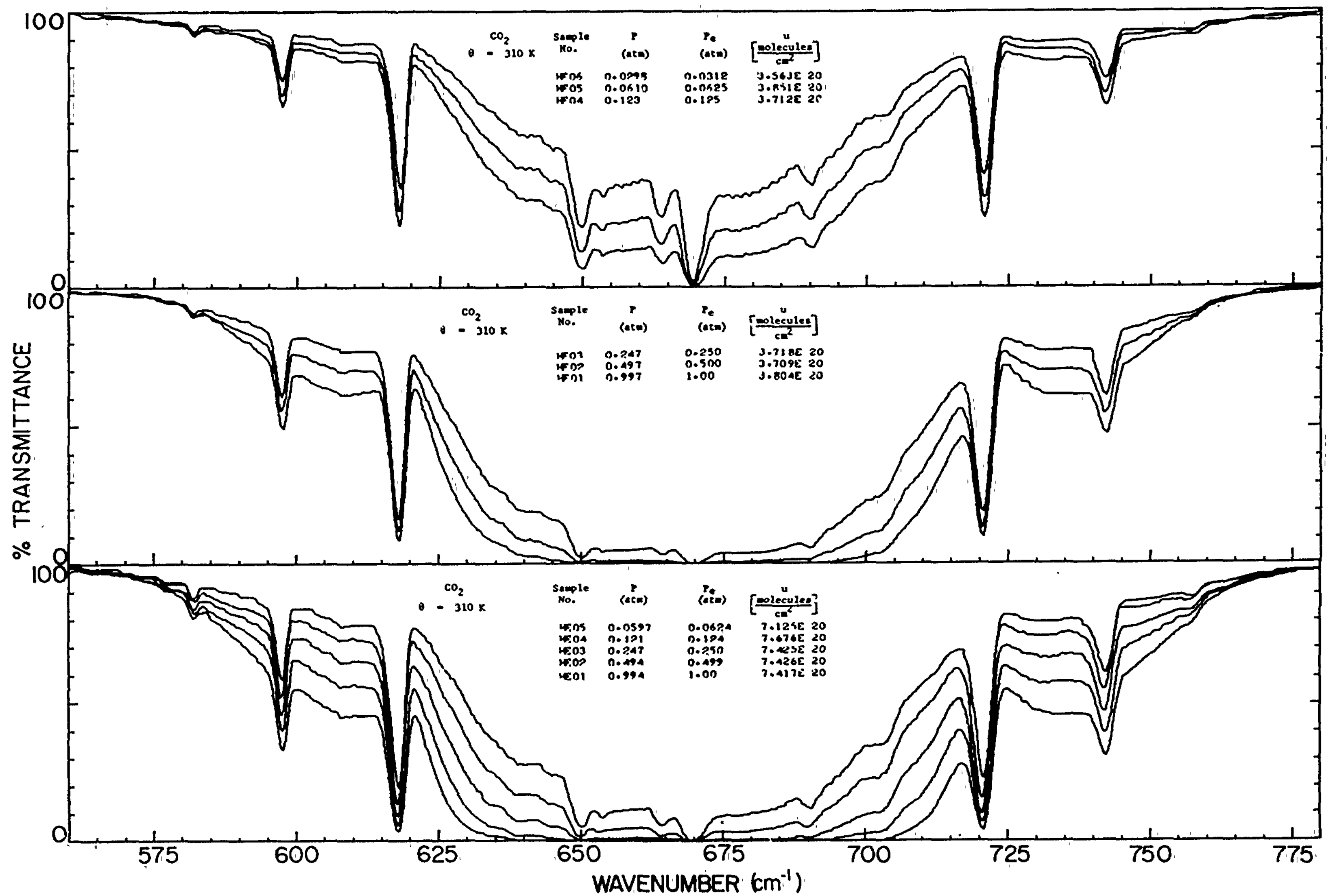

Figure 11. Spectral plots of transmittance of several CO_2 samples near 310 K.

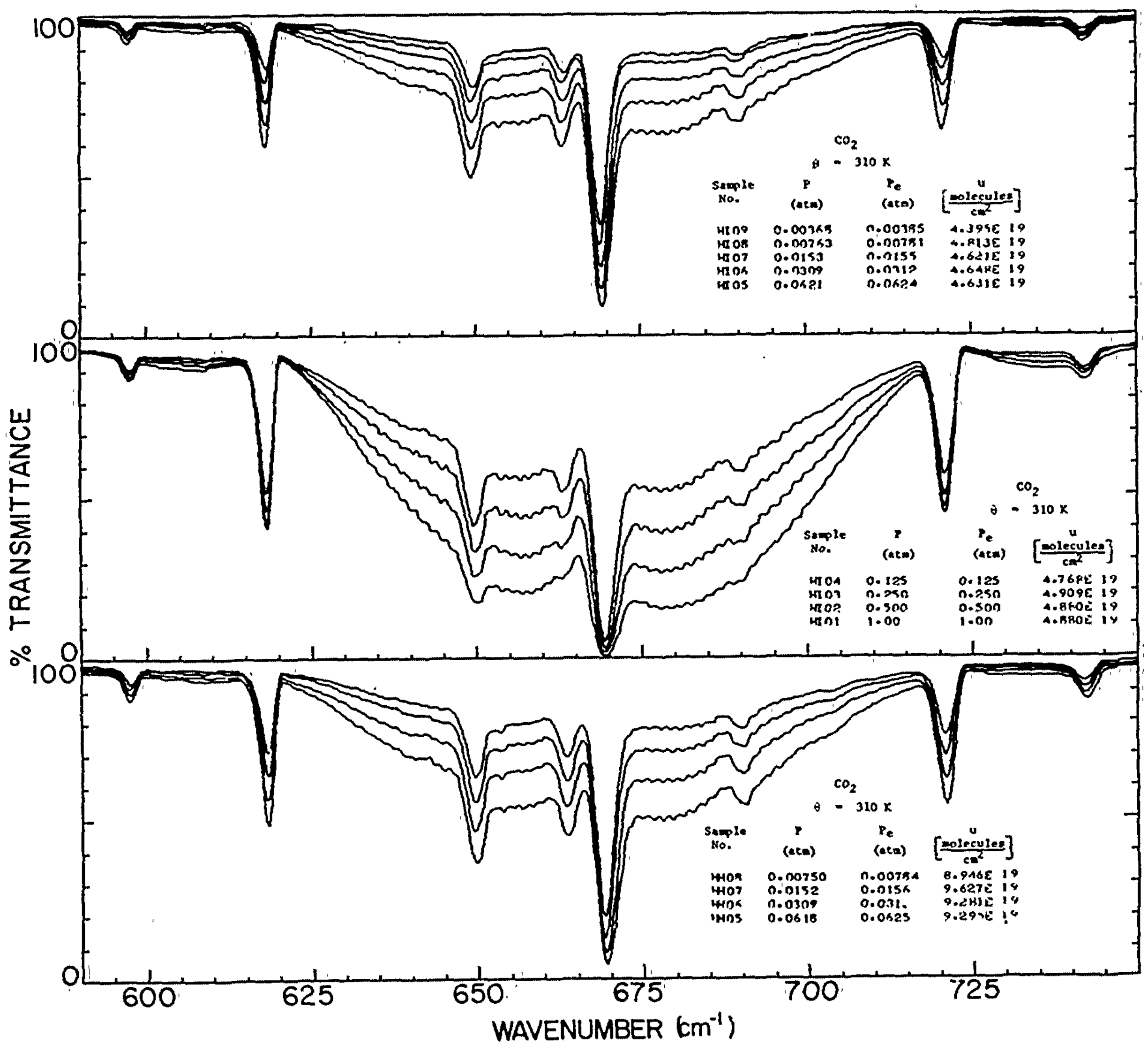

Figure 12. Spectral plots of transmittance of several CO_2 samples near 310 K.

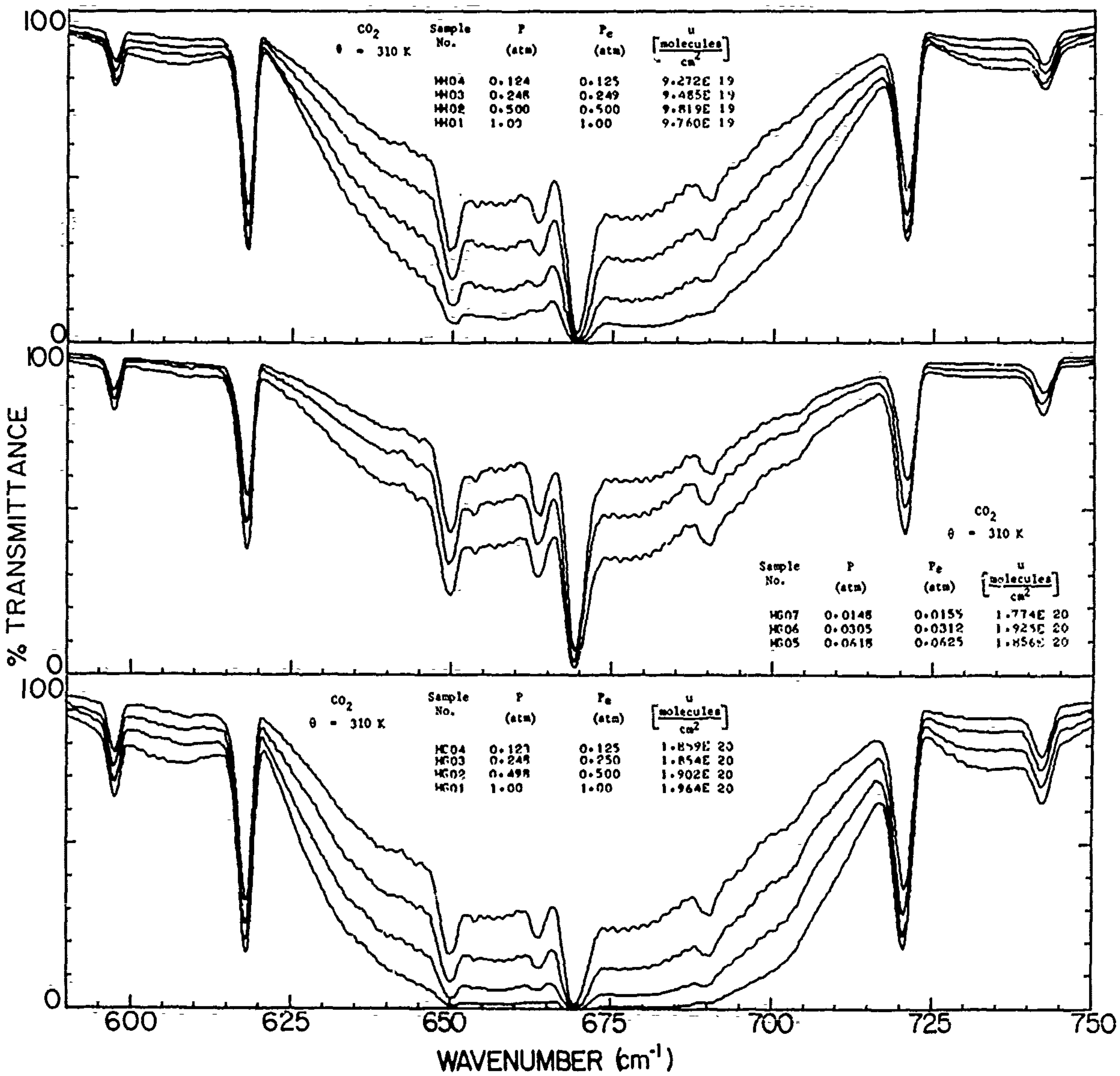

Figure 13. Spectral plots of transmittance of several CO_2 samples near 310 K.

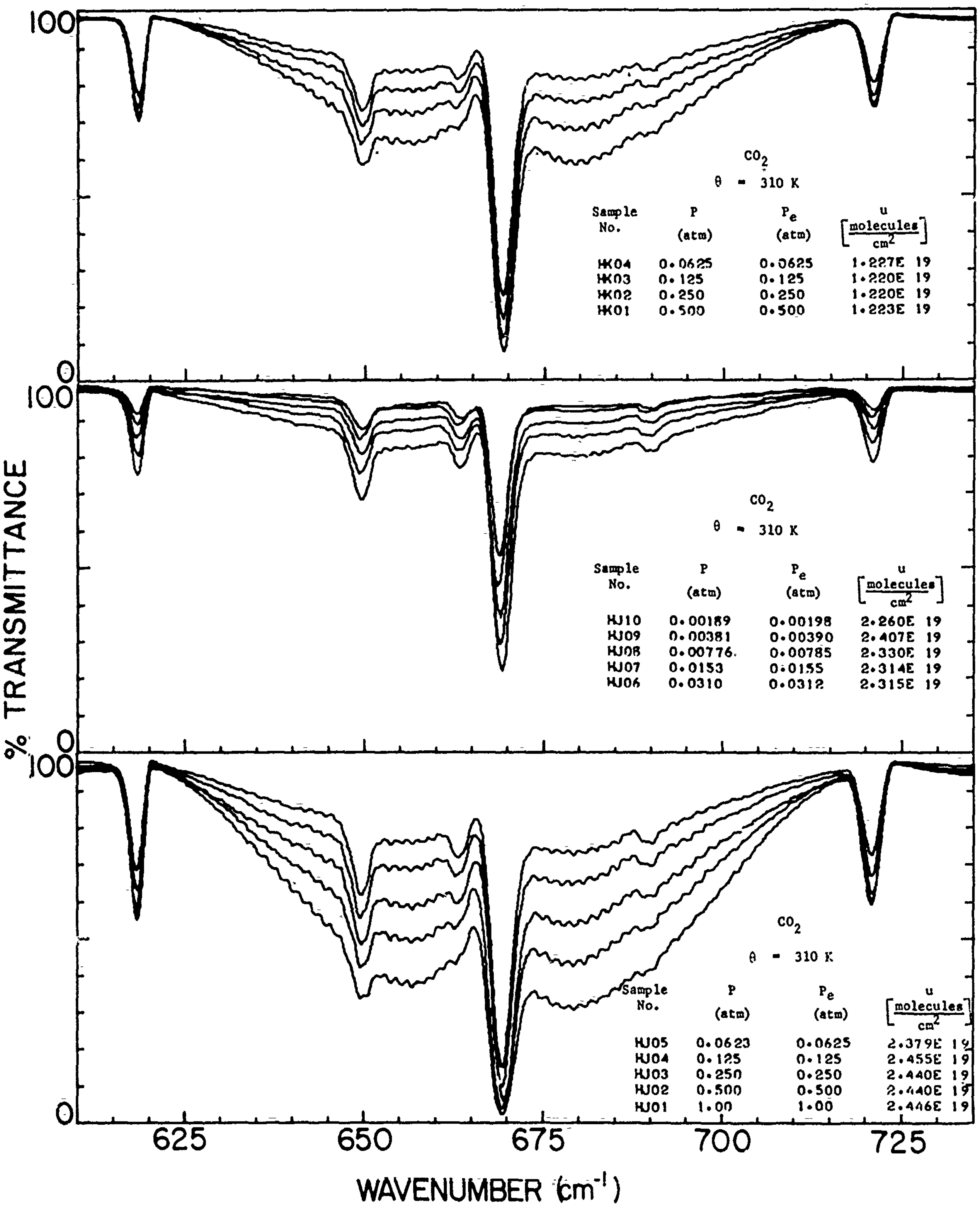

Figure 14. Spectral plots of transmittance of several CO_2 samples near 310 K.

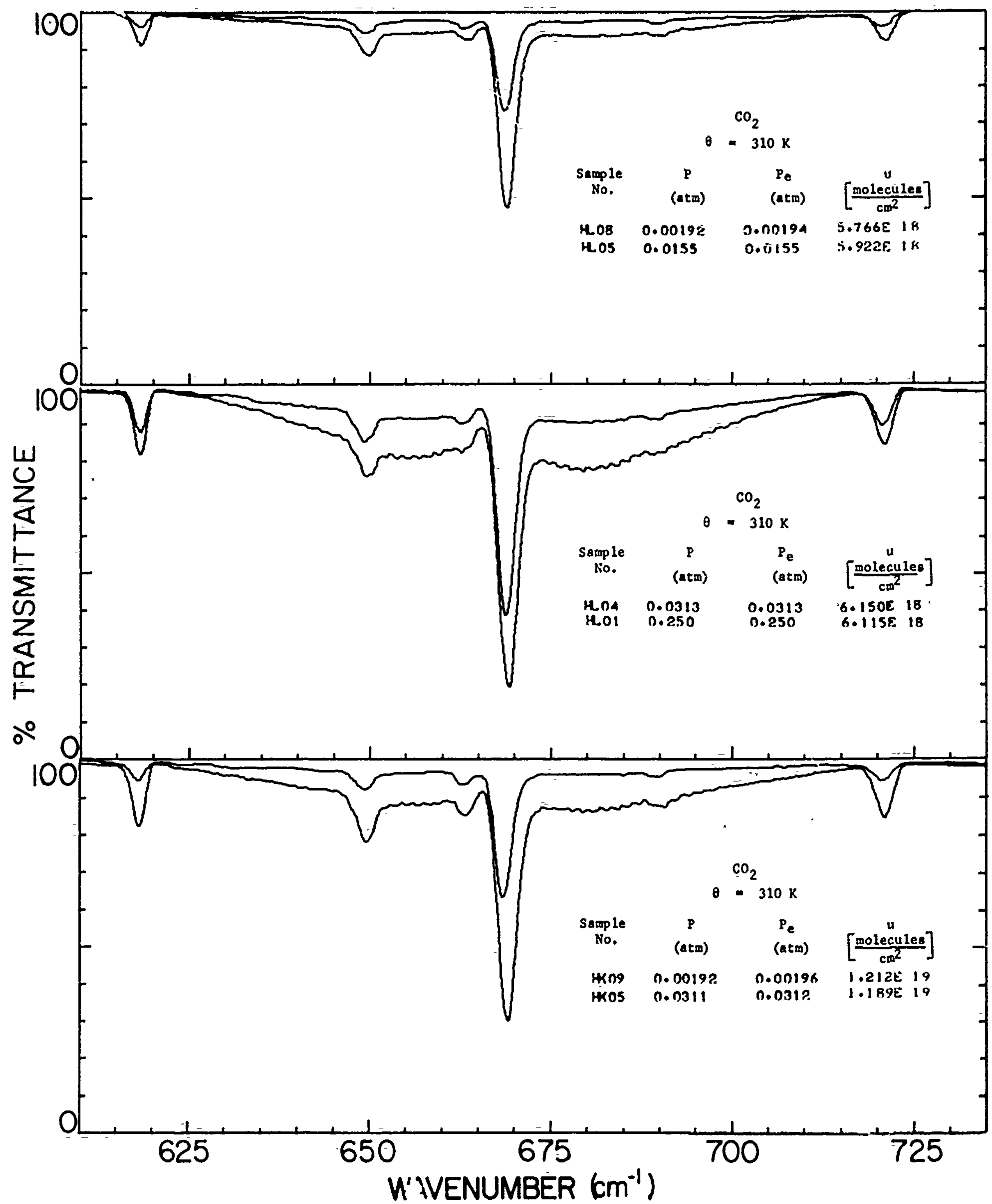

Figure 15. Spectral plots of transmittance of several CO_2 samples near 310 K.

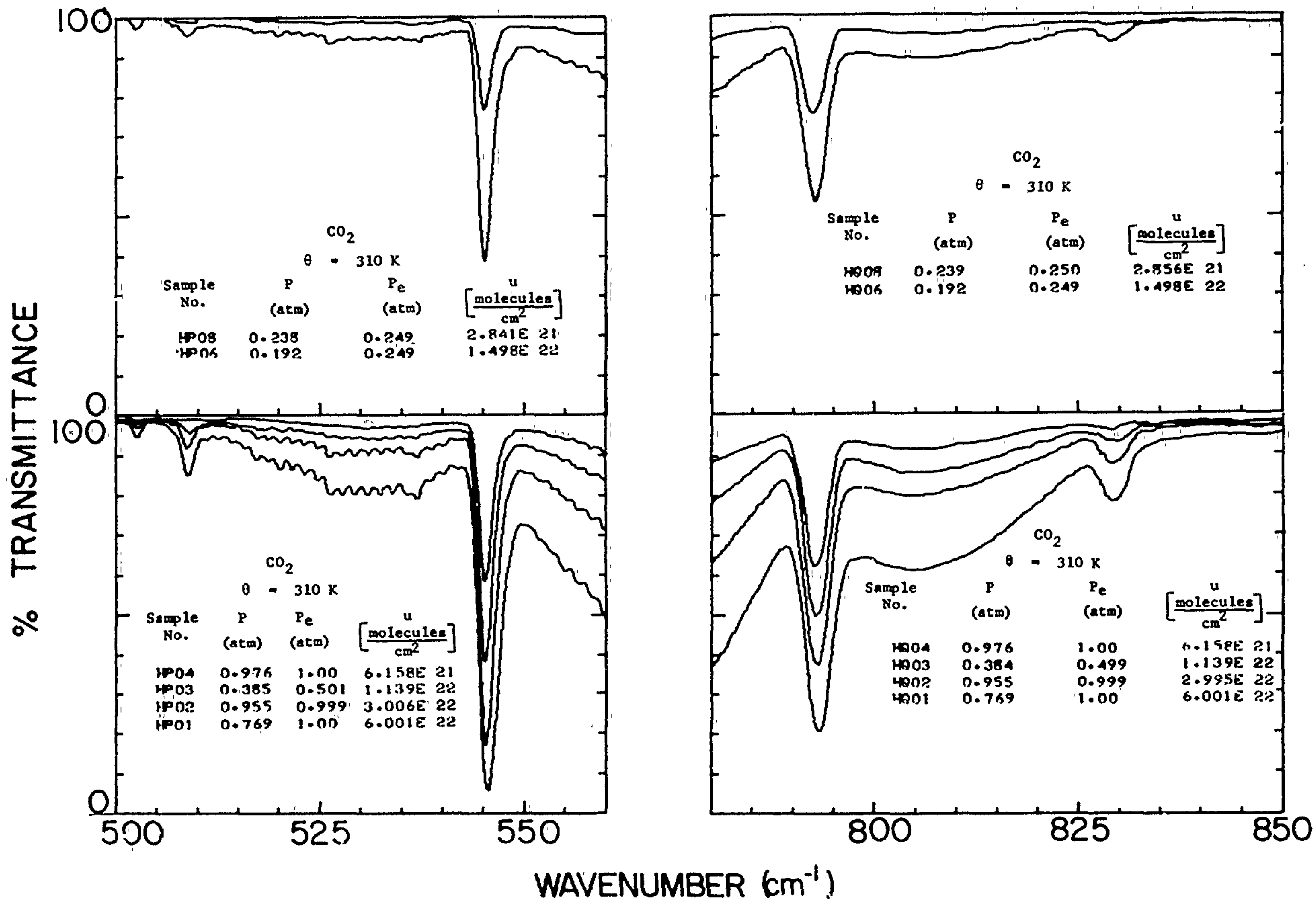

Figure 16. Spectral plots of transmittance of several CO_2 samples near 310 K.

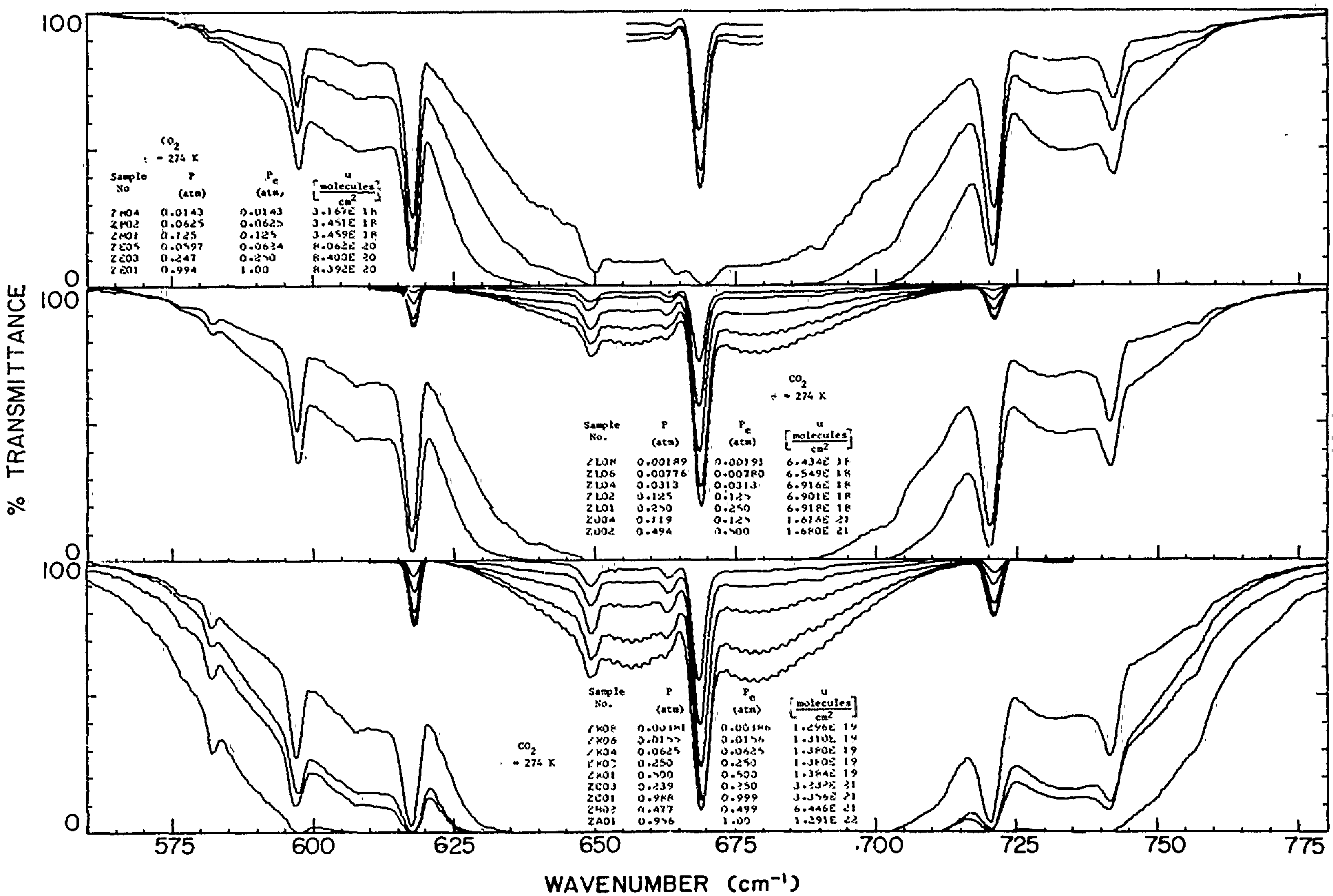

Figure 17. Spectral plots of transmittance of several CO_2 samples near 274 K.

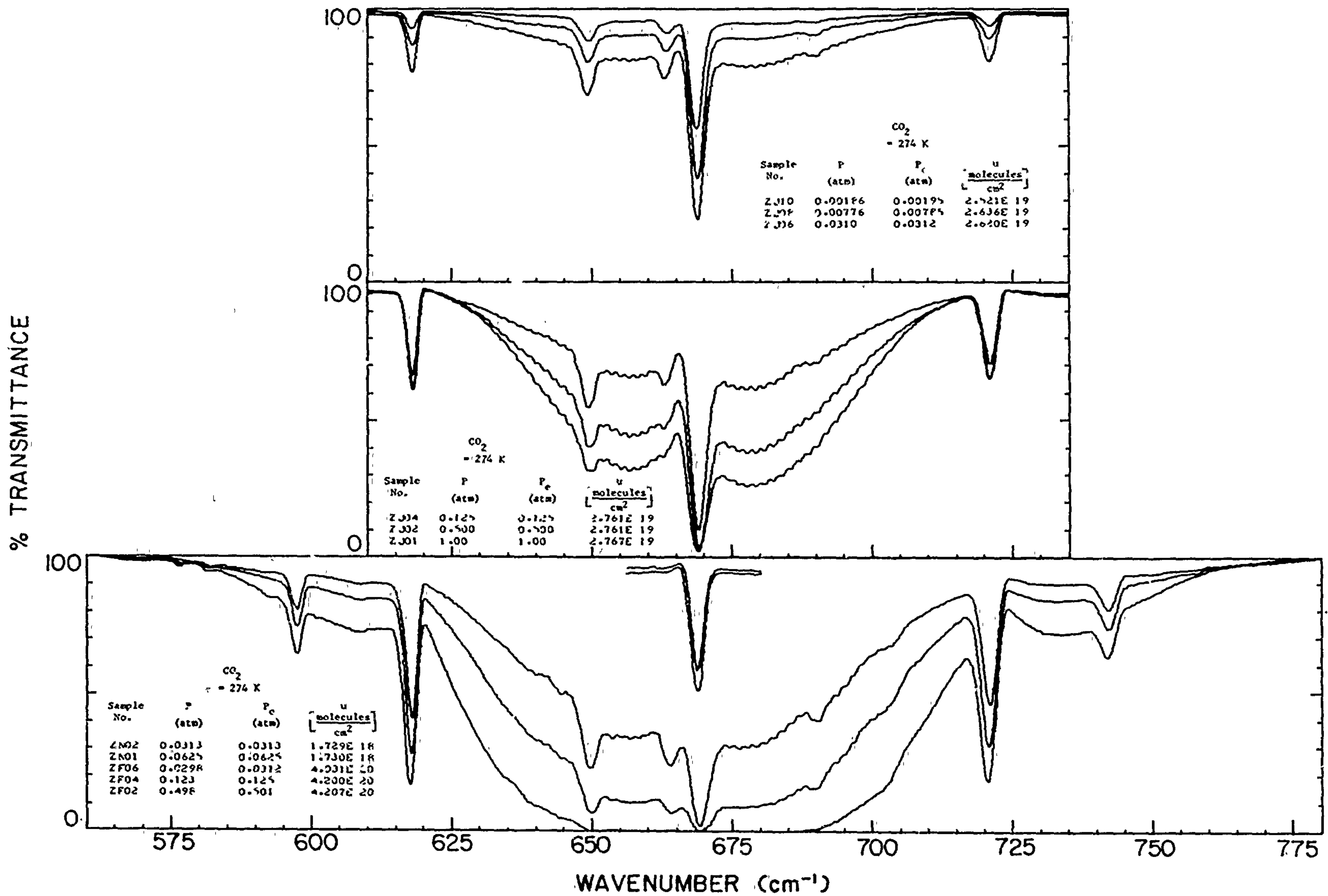

Figure 18. Spectral plots of transmittance of several CO_2 samples near 274 K.

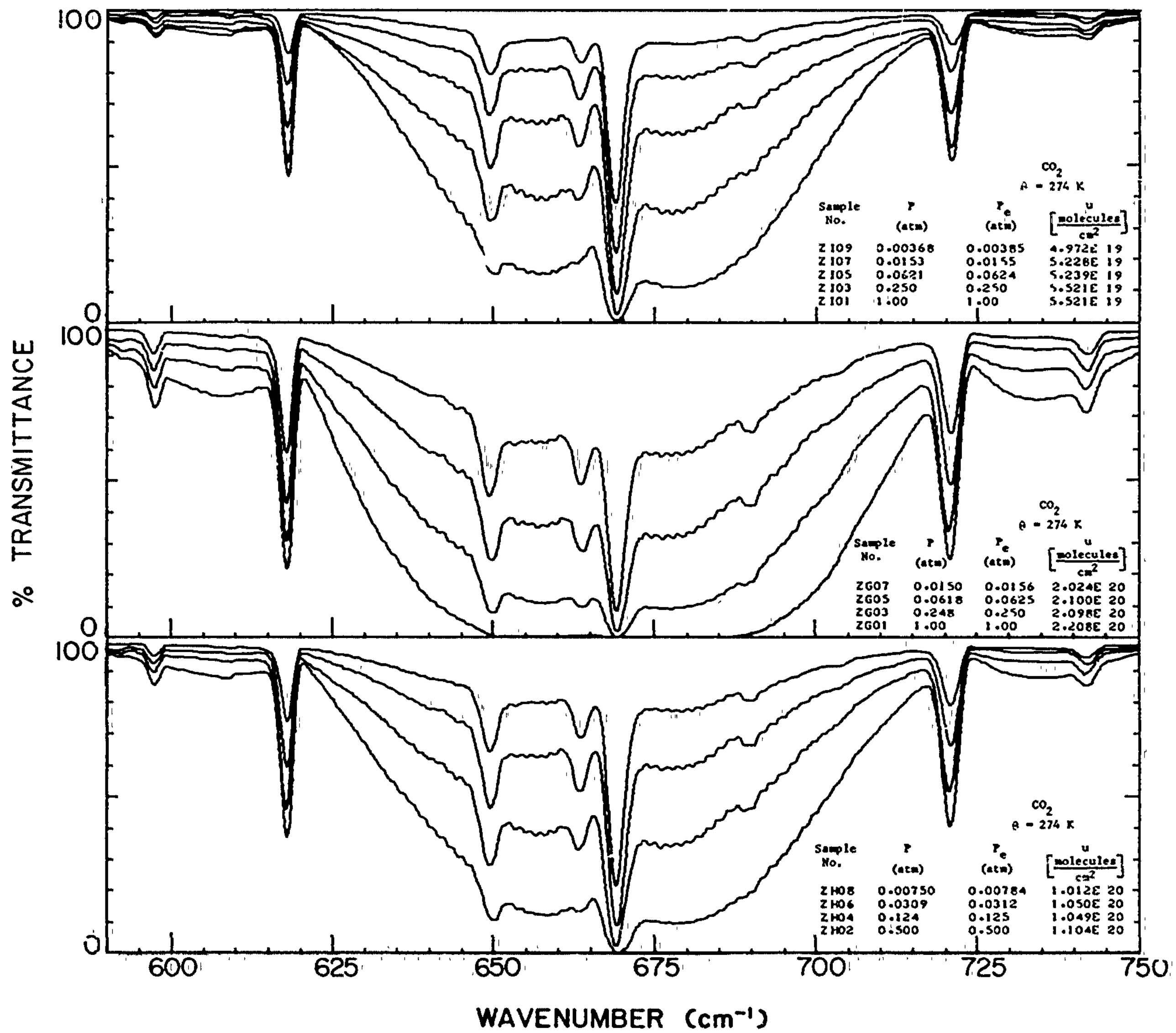

Figure 19. Spectral plots of transmittance of several CO_2 samples near 274 K.

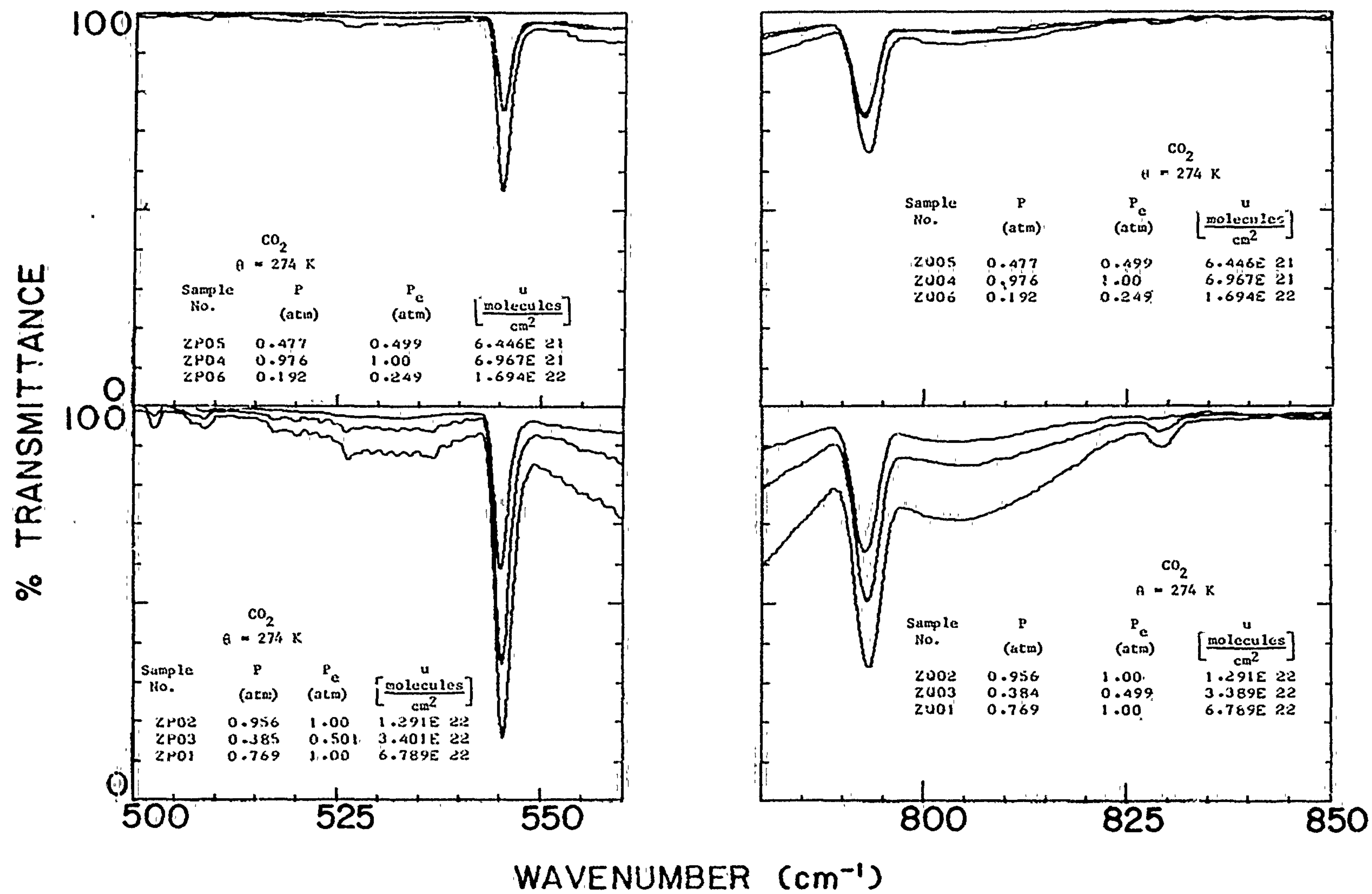

Figure 20. Spectral plots of transmittance of several CO_2 samples near 274 K.

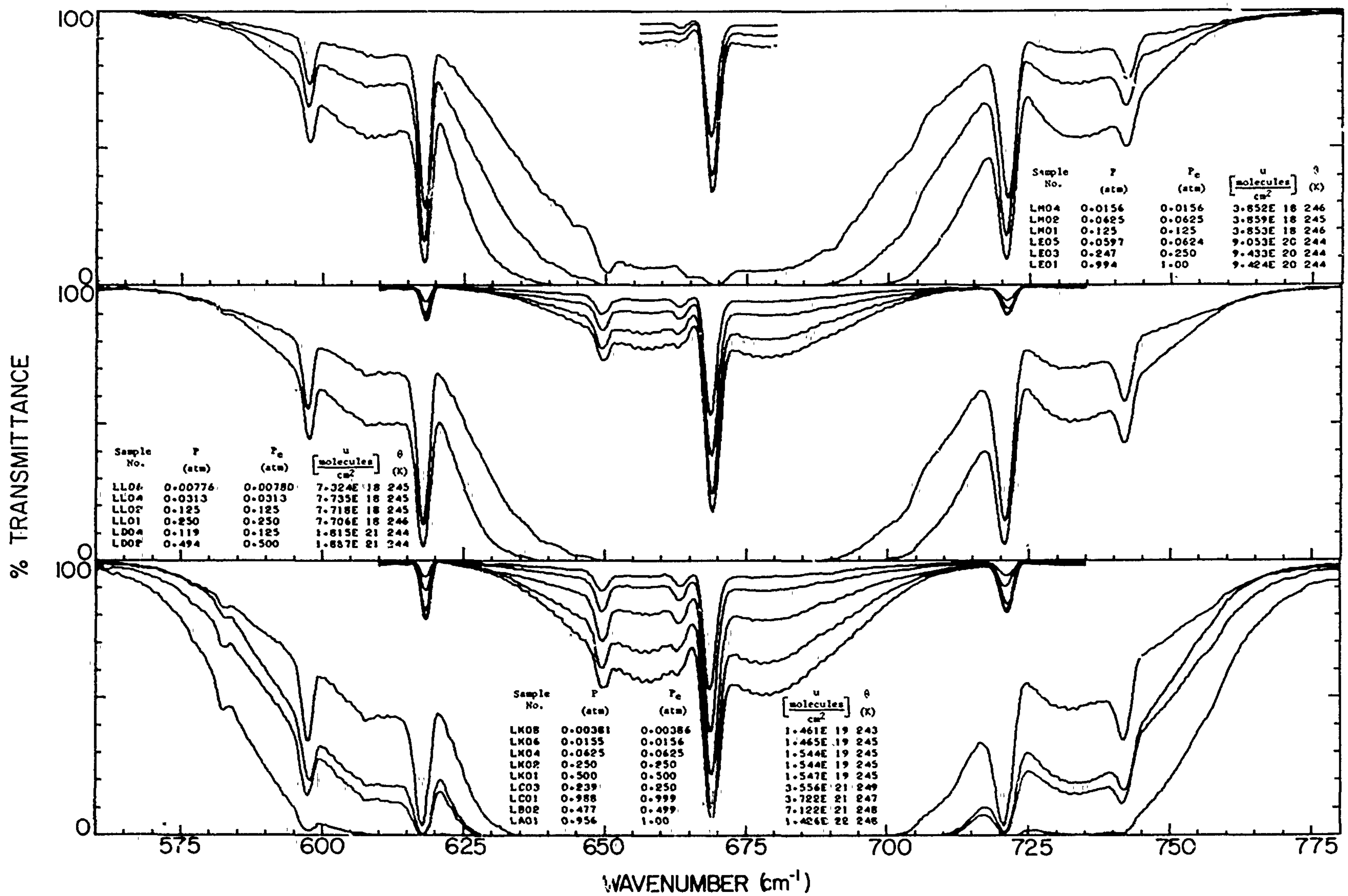

Figure 21. Spectral plots of transmittance of several CO_2 samples near 245 K.

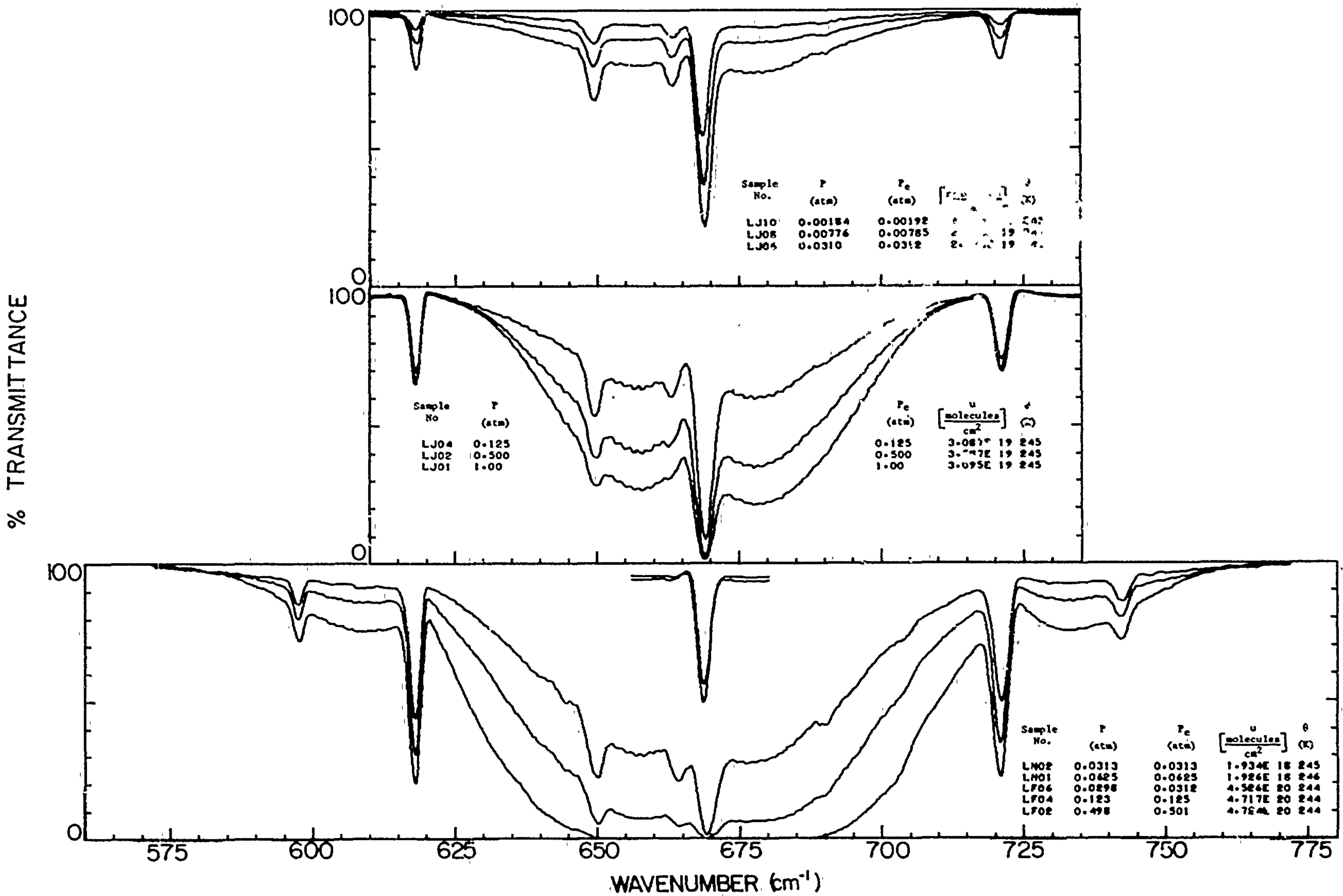

Figure 22. Spectral plots of transmittance of several CO_2 samples near 245 K.

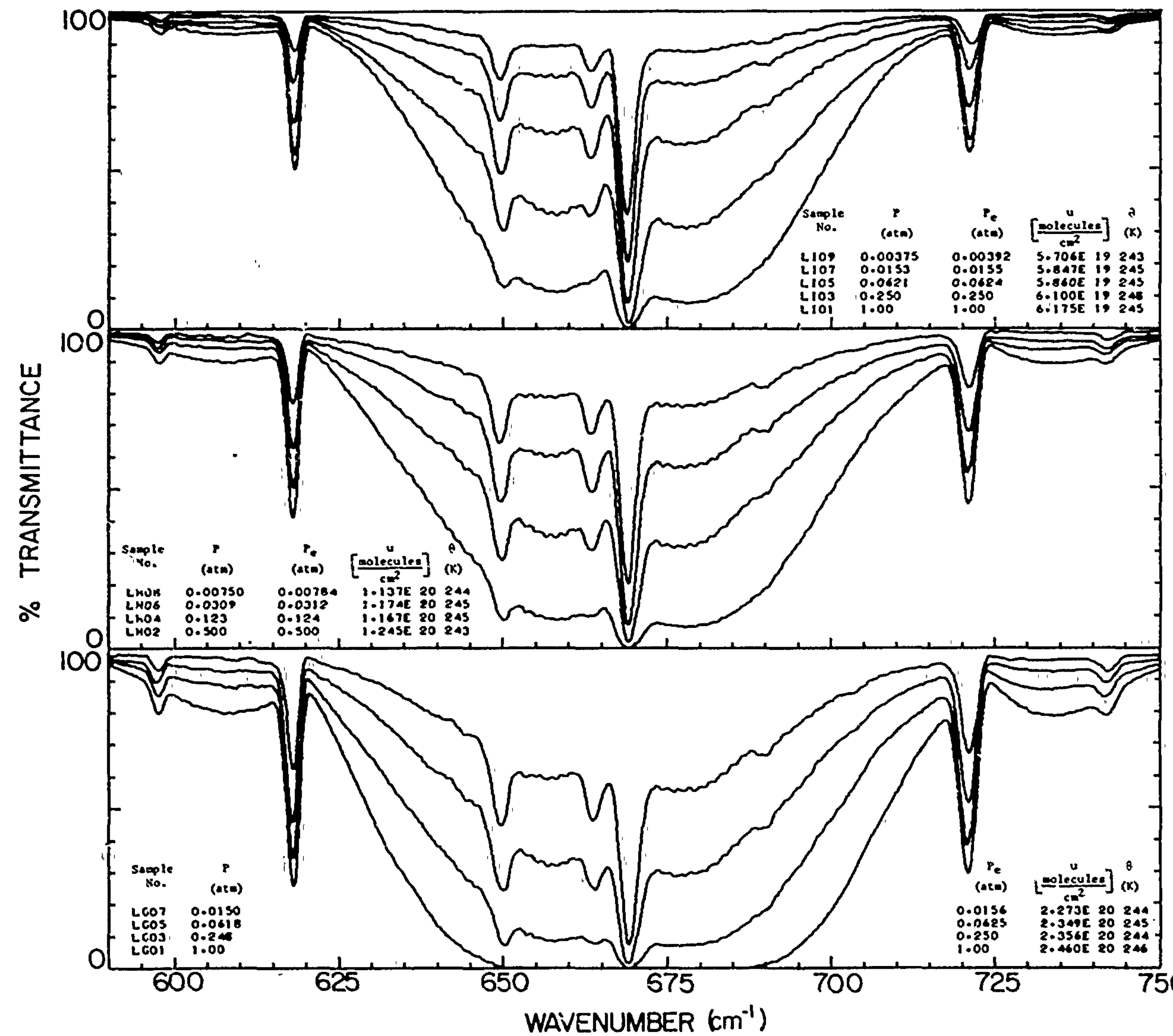

Figure 23. Spectral plots of transmittance of several CO_2 samples near 245 K.

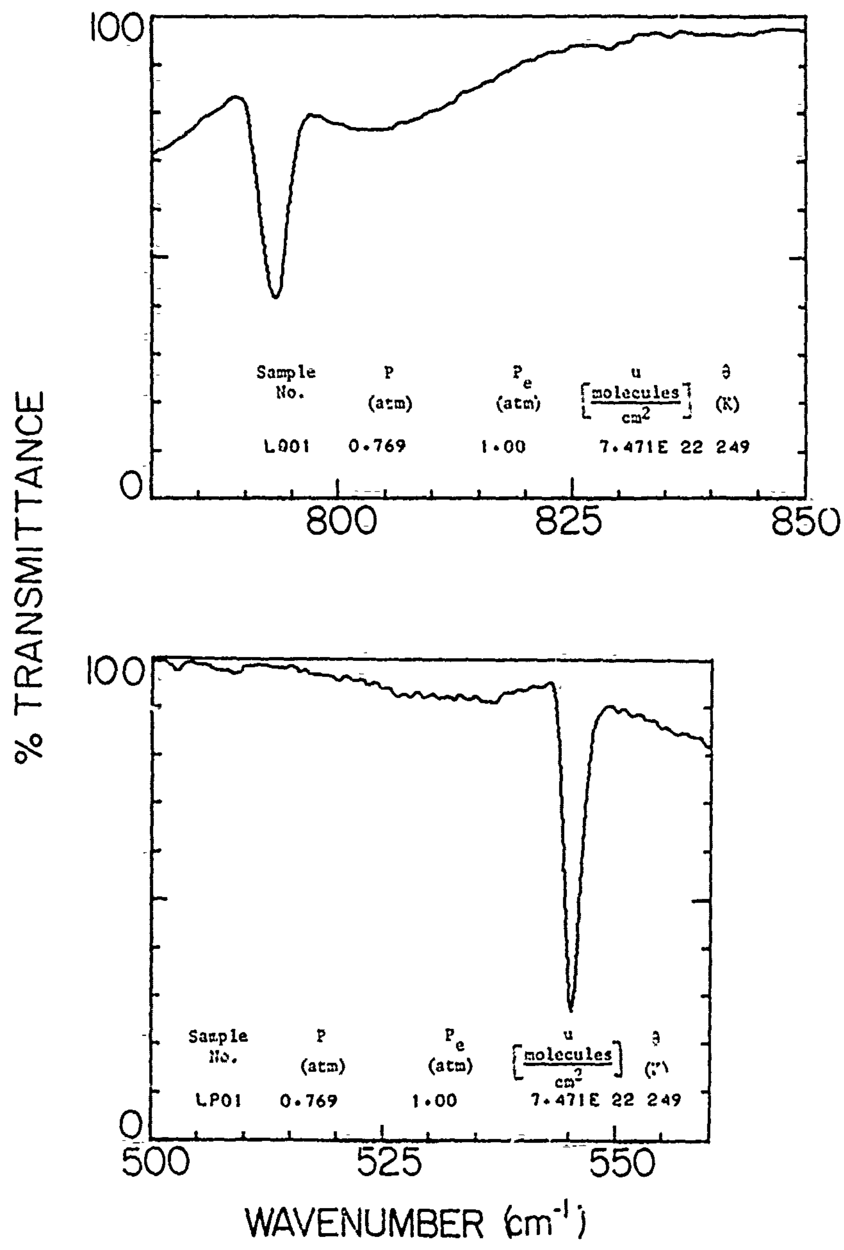

Figure 24. Spectral plots of transmittance of several CO_2 samples near 245 K.

SECTION 6

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